SCIENTIFIC AMERICAN

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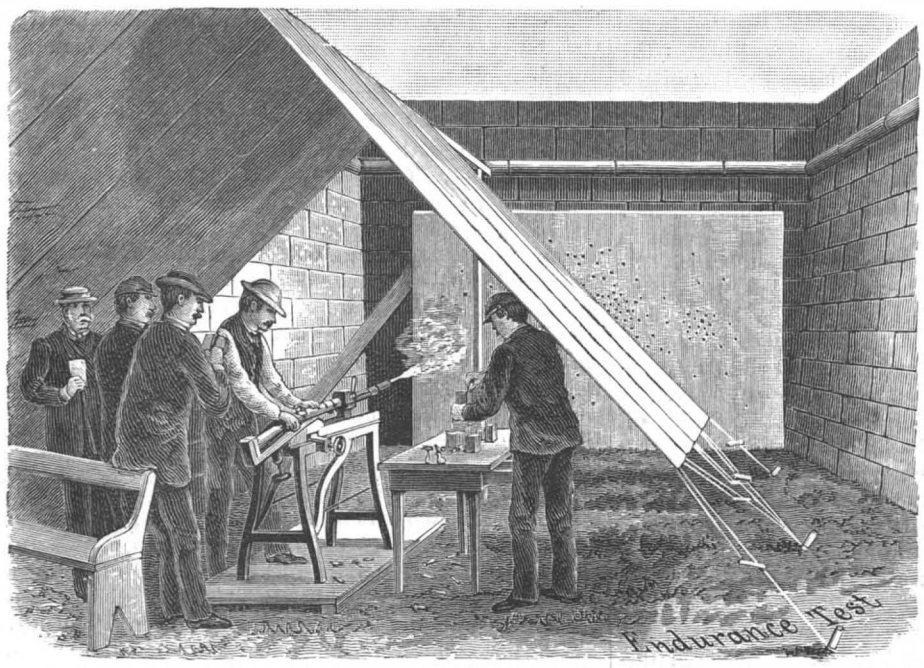
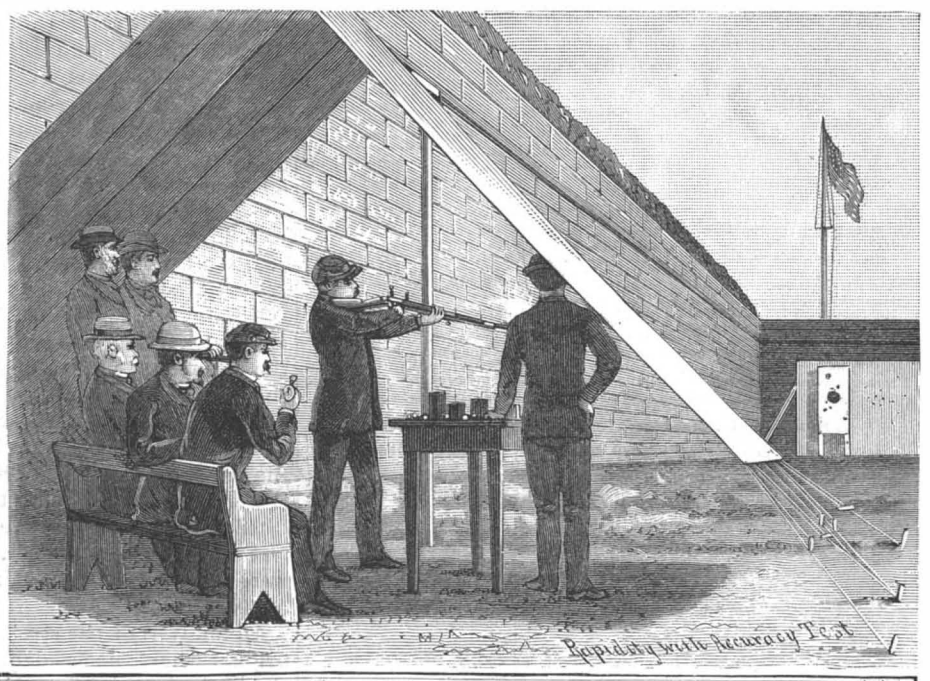
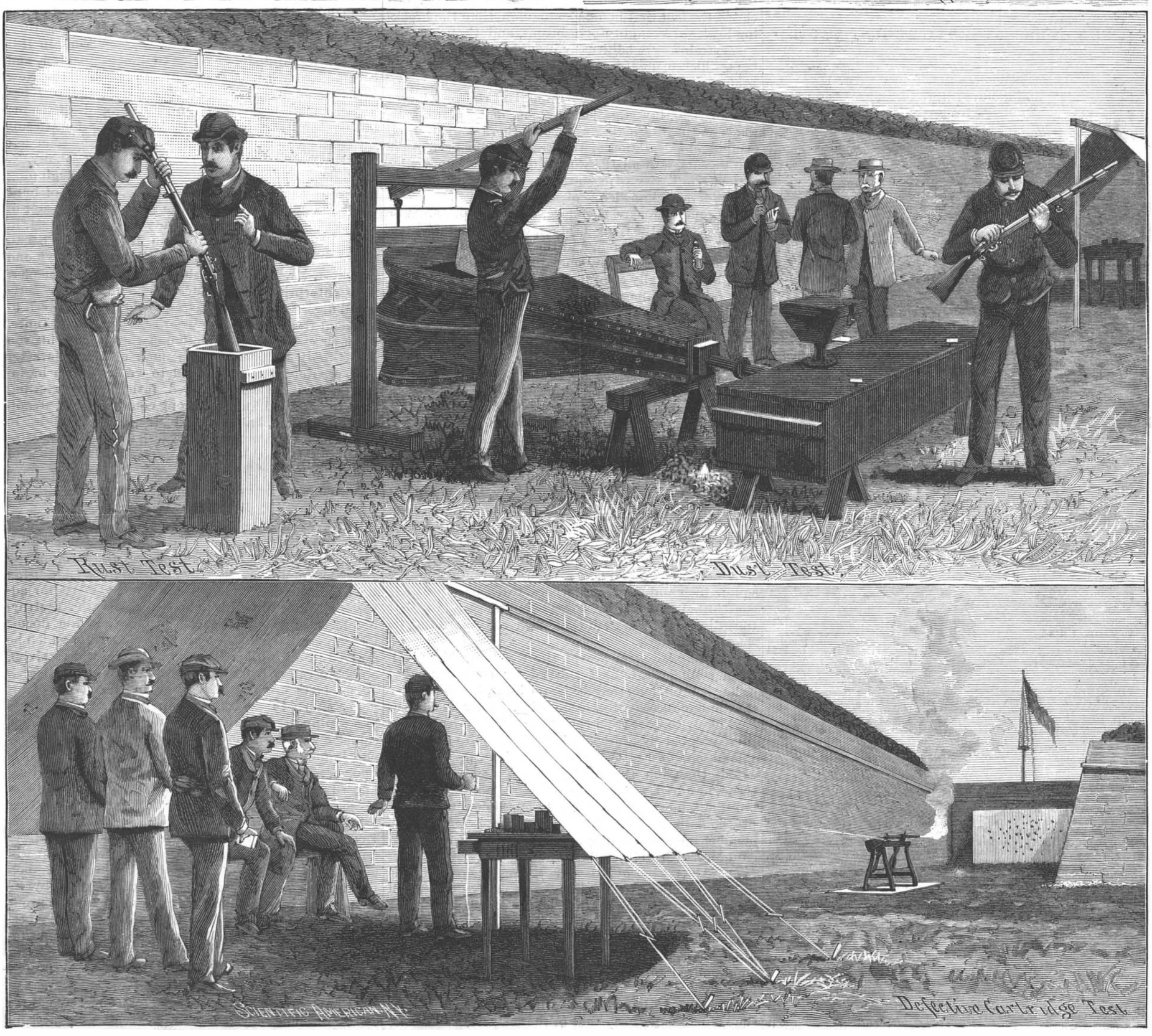
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXV.—No. 8. ESTABLISHED 1845. NEW YORK, AUGUST 22, 1891. $3.00 A YEAR. WEEKLY.







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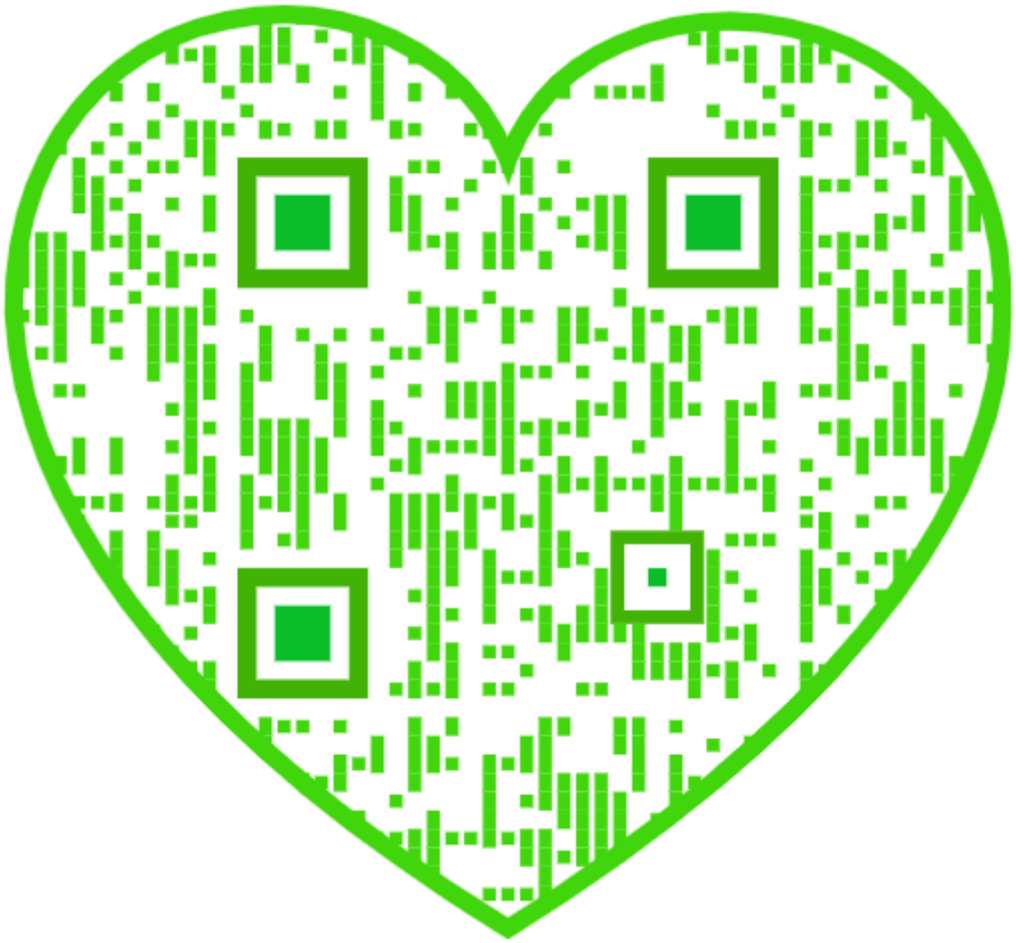

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00

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MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

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NEW YORK, SATURDAY, AUGUST 22, 1891.

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STRAINS ON RAILROAD BRIDGES.

The Board of Railroad Commissioners of the State of New York was established in February, 1883, and within a year from that date a thorough investigation was commenced, for the purpose of obtaining exact knowledge of the strains brought to bear upon the members of all the railroad bridges and trusses in the State. The report of this investigation has just been published and makes a volume of nearly two thousand pages.

The commissioners were moved to take this action by the occurrence of several accidents from defective bridges. On February 17, 1883, a temporary bridge or trestle over Allen's Creek, on the Genesee Valley Railroad, between Rochester and Hinsdale, gave way while a freight train was crossing which resulted in the death of the fireman and the severe bruising of the engineer. The master carpenter of the road admitted that he had recently made repairs to the bridge, but that he did not understand calculating the resistance of beams or trusses to strains. On October 22, 1883, an accident occurred on the Glens Falls branch of the Rensselaer and Saratoga Railroad, when three persons were killed and twenty-two wounded. The person in charge of the division of this road upon which the accident occurred declared that he was unable to calculate bridge strains, being merely a bridge carpenter by trade. He judged by experience as to what the different members ought to be, and the strains on the bridge had never been calculated by anybody.

At Weedsport, on the Southern Central Railroad, February 14, 1884, a train had reached the bridge over the Seneca River, when the north span gave way, and the engine, tender, and two box cars were precipitated into the river where the water was twenty-two feet deep. The engineer, fireman, and a brakeman were drowned, and the cause of the disaster was a defective truss.

An analysis of the strains upon the members of the bridges where the accidents above cited occurred disclosed the fact that in one case more than the breaking load was brought upon beams, and that in other cases strains were habitually brought upon web members, which made it a matter of astonishment that the bridges did not give way sooner than they did.

The railroad commissioners found at the very inception of their investigation that on many of the railroads of the State of New York there had been no competent calculation of the strains on the bridges for many years, if at all, the work requiring technical education, familiarity with the theory of mechanics, and a considerable knowledge of mathematics.

The commissioners, therefore, requested drawings or tracings of all the truss bridges, on all the lines, stating the location of each, and the time when built, and full descriptions. Some companies objected to this at first, but all finally complied, and the result has been that railroad managers found defects in many of their bridges of which they had no previous knowledge, and which might never have become known until revealed by some terrible accident. In a number of cases bridges were strengthened before the strain sheets were forwarded to the commissioners. After the sheets were received, they were carefully gone over and recalculated.

The number of railroad truss bridges in the State is about two thousand five hundred, not including the New York elevated roads, the strains upon which have also been calculated. Six hundred and sixty-nine truss bridges have been criticised by the board, of which five hundred and thirty-five have been repaired by the various companies, and one hundred and thirty-four entirely rebuilt. Cases have occurred, particularly in old bridges, where the iron in the suspension rods was strained at twenty thousand pounds to the square inch and more, and where three or more rods constituted the member, there being no certainty that the adjustment was such that each rod was doing its share of the work.

The commissioners accept the weight of the maximum rolling load, as furnished by each company, unless it is obvious that it is too light, in which case they assume a weight of locomotive, tender and train load likely to arise from the traffic of the road. The rules adopted by the commissioners require that iron should not be strained per square inch to a greater extent than ten thousand pounds, and wood than eight hundred pounds, in tension; nor more than ten thousand pounds or eight hundred pounds in compression, diminishing, however, as the length of the member increases in proportion to its diameter, in accordance with well regulated formulas.

There has been of late years a great increase in the weight of rolling stock. There were many bridges still standing which were built when the maximum weight of locomotives and tenders was fifty-five tons, and the maximum weight of a freight car and its load was nineteen tons. Now locomotive and tender weigh one hundred tons, and freight cars with their loads forty tons.

In regard to improvements in modern engineering, the commissioners say that in the early days of bridge building, particularly of iron bridges, it was the custom to construct trusses of complicated forms, the accurate calculation of the strains on which it is very difficult, in some cases impossible, to compute. An approximation close enough for practical purposes is always reached, however, but a better practice now prevails, and trusses of simple form, admitting of no ambiguity, are alone accepted by the best engineers. In exceptional cases complex trusses have to be resorted to, but they are avoided as much as possible.

The report gives an accurate record of the dimensions of every member of every truss railroad bridge in New York State, and of the strains thereon, as shown by the plans and strain sheets filed in the office of the commissioners.

If the same careful investigation and correction could be made of the bridges of all railroads in the country, the dangers from accidents would be very much reduced.

GEORGE JONES OF THE NEW YORK "TIMES."

We record with much regret the decease of Mr. George Jones, of the New York *Times* newspaper, which took place at Poland Springs, Me., on the 12th inst. Mr. Jones, although for many years an invalid, reached the good old age of 80, his mind and faculties clear and active to the very last. He was in all respects an admirable man. His aspirations were plain, simple, and practical. As a manager he was unequaled. He aimed to produce a substantial, reliable newspaper. From this objective nothing diverted his attention, and a splendid success crowned his efforts. Under his direction the New York *Times* reached and maintained the highest position in the esteem and confidence of the public. No paper enjoys a better reputation for excellence in all its departments; while from a pecuniary point of view it is one of the most valuable newspaper properties in the world. George Jones was born in 1811, at Poultney, Vt. His father was a Welshman and worked at slate mining in Poultney. The father and mother both died when George was 13 years old, and from that time on he had to shift for himself. He and Horace Greeley were boys together, and great cronies. Greeley came to New York in 1831 as a printer, and Jones followed him soon after, and became a dry goods clerk. In 1841, when the New York *Tribune* was started by Greeley, young Jones joined him as manager of the publishing department; but Greeley was too wild in his business notions to suit the staid and steady mind of Mr. Jones, who soon left Greeley and set up a newspaper stand at Albany, N. Y. The new business from a very humble beginning soon increased, and in a few years, by dint of hard work and perseverance, Mr. Jones was the possessor of a few thousand dollars in ready money. In 1851, in conjunction with the late Henry J. Raymond, he began the publication of the New York *Times*, Mr. Raymond as editor, Mr. Jones publisher and business manager. The enterprise proved successful. In 1869 Mr. Raymond died, and the entire responsibility of the establishment from that time onward fell upon Mr. Jones.

His successor in the direction of the paper is his son Mr. Gilbert E. Jones, a young man of high character and superior abilities. Added to great wealth he inherits from his distinguished father many sterling qualities of mind, such as strong common sense, steadiness of purpose, habits of industry, and the desire to do in the best manner whatever he undertakes. Under his guidance the New York *Times* will lose none of its brilliant prestige.

DR. C. V. RILEY.

Dr. C. V. Riley, entomologist of the Department of Agriculture, was lately made the subject of a most unjust personal attack by the New York *Sun*, on the alleged ground that the doctor was engaged in using the publications of the department as vehicles for advertising and selling his patented devices for destroying insects; the implication being that the doctor had a pecuniary interest in the devices from which he derived profit, while at the same time he was receiving a regular salary from the government as entomologist.

The facts are that Dr. Riley, in the course of his many efforts to save the country from the immense losses annually occasioned by destructive insects, designed a peculiar form of nozzle by which the poisonous liquids used are sprayed to the best advantage upon trees and plants. This device is now everywhere known as the Riley nozzle; and when directions are given as to the best means of applying the protecting solutions to plants, it is common and natural for the most intelligent writers, Dr. Riley among them, to name the Riley nozzle as the distinctive thing that will give the best results. Now, there is no patent upon the device, it was given to the public freely by its author long ago, he derives not one penny of profit from it, and there was no occasion for the *Sun's* personal assault. This the *Sun* tacitly admitted in a subsequent number, in connection with a protesting letter from Dr. Riley, in which he explains his position as follows:

"I have been officially engaged for over twenty-three years, whether as a State or government officer, in original work having for its main object the control of

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the numberless insects which injuriously affect our agriculture. During that period I have, either personally or with the assistance of others, made many discoveries of value, some of them of world-wide application and importance, and, from a business standpoint, of great money value.

"With pride, but without vanity, let me add that during all this time, where many have benefited largely, and some have made fortunes out of these discoveries, I have not received one cent therefrom beyond my legitimate salary. I have never taken a fee for information given (though often pressed to do so by honest and grateful beneficiaries, who saw nothing wrong in the proffer); have never attempted to control any of these discoveries for my own benefit; have never applied for a patent on any of them; and have strenuously opposed all attempts to do so that have come to my knowledge, whether by those employed under me, or by those not so employed. A few examples will, perhaps, give force to these statements:

"In 1868, for the Colorado potato beetle, and again, in 1873, for the cotton worm, the value of the arsenites was made known chiefly by my labors. Vast sums were made in the sale of various preparations of these insecticides for those purposes, and I was vainly urged to lend my influence and join in the resulting business.

"In 1871 my discoveries in connection with the grape phylloxera were the basis of a vast industry which has not yet ceased, and which has greatly enriched some of our vineyardists. The first applications from France for cuttings of such resistant stocks came to me, and a prominent Missouri grape grower vainly urged me to join him in a business capacity in connection therewith.

"So with the cyclone nozzle and the kerosene emulsion (one of the most effective and universally used insecticides). In each case large profits have been and are being made by those who offer them in various modifications, and under various names, and in each case I have been urged in vain to lend my name to share the proceeds of some business enterprise in connection with them.

"My work as a public officer has been for the public good. The inducement to it has been neither the pitiful salary of United States Entomologist, nor any other mercenary end. It has been rather the love of investigation and the consciousness of doing good."

International Congress of Electricians in Frankfort on the Main, Germany.

In connection with the electrical exhibition now open in Frankfort on the Main, an international congress of electricians will be held on the exhibition grounds from September 7 to September 12, 1891.

The call for the congress is signed by the most prominent electricians throughout the world, notable among them being the Americans, Profs. Dolbear and Carhart and Messrs. Edison and Brush.

A large number of papers will be read on various subjects relating to electricity. Discussions of proposed questions will also be had.

Of the American electricians, Prof. Dolbear, of College Hill, Mass., will speak on Electrical Terminology, and Prof. Carhart, of Ann Arbor, Mich., on (1) Substitution of Dynamos for Galvanic Batteries in telegraphy and (2) Regulators for Dynamo Machines. Papers will also be read by the following gentlemen:

Baumgardt, Dresden—Relations between Compressed Air and Electricity.

Von Dolivo-Dobrowolsky, Berlin—Electrical Transmission by Alternating Current.

Epstein, Frankfort on the Main—Use of Electromagnetic Measuring Instruments for Alternating Current.

Feussner, Charlottenburg—Material for and Construction of Measuring Instruments.

Frolich, Berlin—1. Projection of Vibrating Curves and Electric Acoustic Experiments. 2. Production and Use of Ozone.

Heim, Hanover—Accumulators.

Hoeffner, Giessen — Electro-chemistry and Metallurgy.

Holborn, Charlottenburg—Magnetic Conditions of Several Iron Alloys.

Hummel, Nuremberg—Magnetic Work and Currents.

Kahle, Charlottenburg—Accuracy of Measuring Instruments under Varying Conditions.

Kohlrausch, Hanover—The Best Method of Teaching for Electricians.

Lahmeyer, Frankfort on the Main—Improvements Relative to Currents.

Lindeck, Charlottenburg—Normal Elements.

Lowenherz, Charlottenburg—Normal Screw Threads.

May, Frankfort on the Main—Rules for Electric Transmissions according to Insurance Companies.

Meissner, Gottingen—Use of Lippman's Capillar Electrometer for Cable Telegraphy.

Muller, Hagen—Accumulator Switches.

Weber, Zurich—Theory of Incandescent Lighting.

Among the subjects proposed for discussion are:

Kareis, Vienna—1. To Prevent Others from Listening on the same Telephone Wire. 2. To Prevent Disturbances in Telephone Lines through Strong Currents. 3. To Improve Electrical Transmission in Telegraphy.

Penkert, Brunswick—About Electric Counters.

Rothen, Bern—Should a City System be Single or Double?

New Trials of the Sims-Edison Torpedo.

An interesting trial of this torpedo, in which some improvements have been effected, was made at Willets Point, near New York City, on August 12, in the presence of many engineers and officers of the navy. The construction of the torpedo is substantially the same as the one tried last year, which was illustrated and described in the SCIENTIFIC AMERICAN of July 26, 1890; but on the present occasion a longer cable was used, so that the torpedo was adapted to a range of over two miles. It will be remembered that the torpedo is a cigar-shaped copper cylinder about thirty feet long, adapted to carry four or five hundred pounds of a high explosive in its forward end, while about amidships it contains an electric motor and steering device, with a coil of cable to be paid out as the torpedo moves, and keeping it in constant connection with the shore. The torpedo is propelled by a thirty inch two-bladed propeller, and is suspended about six feet below a yawl-like float, the deck of the latter being only about six inches out of water.

In the recent trial the compartment for the explosive was filled with gravel, and the whole outfit weighed about three thousand pounds. The machine was lowered into the water and towed to the end of a pier, when it was started toward a yawl a mile off, by the turn of a crank on a switchboard, Mr. W. Scott Sims directing its course, and making it turn to either side at will. The torpedo was sent around the yawl, and close to poles set up near it, being evidently under perfect control, and came back at high speed to the starting point, the cable being laid in a loop on the bottom. Mr. Sims stated that she had developed 32 horse power, instead of 52, for which she was designed, and that her propeller had made 700 revolutions per minute instead of 850. Her speed was given as at the rate of twenty miles per hour, though it is thought she can readily run at a twenty-two mile rate, this being only the second trial of this boat. The amount of wire cable carried by this torpedo was 13,000 feet, the cable carrying two insulated conductors, one affording the power and the other connected with the tiller by which the device is steered.

When the torpedo was started by the turning on of the current, there was at first a slight strain on the cable and her nose plunged under the water several inches, while the froth came tumbling over the stern in a torrent. Then the slack ran out more easily, the bow came up and the stern dropped as does the stern of such a fast boat as the Cushing, while the water was thrown up in shining sheets more than two feet on each side of the knife-edged bow. On her return, after rounding the boat a mile off, full power was turned on, and the sight of the shining sheet of water and spray as she came driving in was thrilling. Arrived near the wharf, the bow was seen to be about a foot out of water, while about three-fourths of the hull was submerged in the foam of the wake.

It is evident from trials like this that the Sims-Edison torpedo is a highly valuable adjunct for harbor defense and also for naval operations in general.

A Home Contract for Big Guns.

Gen. Grant, Acting Secretary of War, in behalf of the government, entered into a contract on August 9 with the Bethlehem Iron Company, of Pennsylvania, for one hundred new high-power guns, in accordance with a recommendation made some time since by the Board of Ordnance and Fortification. Of these twenty-five will be 8-inch breech-loading, single charge, built-up, forged steel rifle guns, $17,246.55 each; fifty 10-inch guns, same pattern, $35,747.58 each; twenty-five 12-inch guns, same pattern, $54,473.22 each.

Under the contract the first of the 8-inch guns is to be delivered in 730 days, and the remaining twenty-four at such regular intervals that the last one will be delivered in 2,433 days "after notification of the acceptance of the type gun." This means nine years for the delivery of the twenty-five guns. The first, or type gun, of the 10-inch class is to be delivered in 822 days, or in two years and three months. Within 8,407 days after acceptance of the type gun the remaining forty-nine are to be delivered at regular intervals. This means nearly twelve years for delivery of the 10-inch guns. The first of the 12-inch guns is to be delivered in 1,095 days, and the remaining twenty-four at such regular periods that the last one shall be delivered in 3,194 days after the acceptance of the type gun. This means twelve years, or a little more, for delivery of these guns. It does not follow, however, but that the guns may be completed in far less time than the contract provides, and this is the more probable as the next Congress is likely to be called on to make further appropriations for large guns, the one hundred now contracted for being but a small proportion of the number actually needed.

The fact that this contract was made with an American firm, and that there were three American manufacturers ready to undertake the work, cannot fail to give general satisfaction. Four or five years ago it would not have been possible to place such a contract in this country, and efforts to secure favorable bids for these guns failed last year because the appropriation therefor was not large enough. At the last session of Congress, however, it was increased to $4,225,000, with the special provision that the prices paid should be such as would be "deemed fair to the manufacturer." The total of the bid of the Bethlehem Company for the one hundred guns was $3,785,850; that of the two other competitors for the work was, the Midvale Steel Company, $5,359,500, and the South Boston Iron Works (now established in Kentucky), $5,174,312. Should the next Congress call for more big guns, these firms, perhaps re-enforced by the firm of Carnegie, Phipps & Co., of Pittsburg, and may be others, might be counted upon as among the possible bidders, thus demonstrating that in this specialty our manufacturers are enlarging their facilities to the standard of the foremost establishments of England, Germany, and France.

Some comment has been made upon the high cost of these guns, coupled with the statement that they could be built for much less money and in half the time at the government arsenal at West Troy. It seems to be generally conceded that the government could do the work cheaper and quicker than called for by the contract, but it was manifestly the plain intention of Congress, and in accordance with a strong public sentiment, that private enterprise should be encouraged in the establishment of gun plants, in order that the available facilities of the country in time of need should not be limited to one or two government gun-making shops. It will do no harm, however, if the attention of Congress is now so directly turned to the subject that the Watervliet arsenal will receive an adequate appropriation for the much needed enlargement of its plant. It will be some years before our sea coast defenses and our new ships can be fully supplied with the heavy guns needed for their proper equipment by the combined work of a first-class government gun factory and a very liberal number of contracts with private gunmakers besides.

James Russell Lowell.

At his Elmwood home, Cambridge, Mass., on August 12, died James Russell Lowell, in the 73d year of his age, his birthday having been February 22, 1819. He was of a family which has made a name in Massachusetts history and in connection with Harvard College, the Lowell Institute, of Boston, having been founded and endowed with $250,000 by one member, and a leading city in the State perpetuating in its name the memory of another member. Mr. Lowell was graduated from Harvard College in 1838, when he studied law two years, and was admitted to the bar, but did not practice. Inheriting a competence, he was at liberty to follow the literary pursuits for which he was inclined, and in 1841 published his first volume of poems. He thereafter became a regular contributor to several periodicals, and frequently published poems whose wit and pathos, united with a singularly engaging style, attracted a constantly widening circle of readers, but it was not until 1846–48 that he began to attain a national reputation.

During these years was published the first series of the "Biglow Papers," a collection of political satires in Yankee dialect, directed mainly against slavery and the Mexican war. A second series appeared at the time of our civil war, and their effect in arousing and sustaining public sentiment in opposition to the cause of the South was very great. Although put in homely phrase, and giving expression in rugged earnestness to emotions and experiences ostensibly of the most simple-minded of people, it was at once felt that they were the work of a scholar and poet of a high order, and the "Biglow Papers" immediately attained a reputation in England almost as great as they achieved here. Of the other literary work of Mr. Lowell, dear as many of his poems are to scores of thousands wherever the English language is spoken, these columns are hardly the place for even a brief mention, although the sweetness and beauty of his verse, with the lofty ideals of pure character and high endeavor, and the hatred of selfishness and all forms of deceit, by which it is preeminently distinguished, have earned for his productions a high place in the classics of the language.

Of his diplomatic career of three years as minister to Spain and eight years as minister to England, it is only necessary to add that he filled both offices with entire credit to the country, and greatly advanced the reputation of America and American scholarship among foreign people.

THREE and two-tenths grains make one carat; 150 carats in one ounce of Troy weight; 1,800 carats in one Troy pound of 5,760 grains.

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How to Pack Drugs and Chemicals for Export.

The following suggestions will be found of practical value:

1. Salts should be put in stoppered glass bottles or packed in casks, if sent in large quantities. Casks used for hygroscopic salts should be lined with oil cloth or parchment paper. Salts should never be packed in tin boxes or in paper only.

2. The glass stoppers of all bottles containing either liquids or dry substances should be greased with a little vaseline in order to avoid any difficulty in removing them.

3. Parts of plants, such as leaves, roots, etc., should be packed in sacks, and these again in cases; very delicate drugs in tin boxes. Vegetable powders should be packed in hermetically closed glass bottles or tin boxes. Drugs which occupy much space should be pressed as much as possible before being packed, especially if the shipping freight is calculated according to the bulk of the goods.

4. Boxes and cases should be lined with zinc, or where this is too expensive a strong and good oil cloth will usually be sufficient.

5. Although the utmost care is necessary in packing, yet packing materials such as hay, straw, etc., should be used as sparingly as possible, as duty has usually to be paid for the weight of these as well as for the goods themselves.

6. Cases should be secured by iron bands, and it is always desirable that the weight and volume of cases should be as small as possible.

7. Acids, caustic or inflammable substances must be packed according to the regulations of the different railways by which they are transmitted prior to shipment. As a rule stone bottles are best for acids and ammonia, and glass or tin vessels for volatile substances. All these should be closed by corks saturated with paraffine, and then wrapped in sail cloth, which, with the string securing it, should also be soaked in paraffine.

8. Acetic acid may be safely conveyed from place to place in carboys of 5 to 10 gallons capacity.

9. Liquor ammonia should never be put into iron vessels.

10. Vessels containing volatile substances should never be quite filled.

11. As acids and caustic and inflammable substances are conveyed on the decks of sailing vessels only, the cases containing them should be well closed, and the address, mark, number, etc., be such as will resist sea water.

12. Liquids should not be packed in the same case with dry substances.

13. Valuable or expensive chemicals, such as ethereal oils and essences, should be packed in strong tin vessels and closed with corks saturated with paraffine as before described.

14. The weights and measures of the country to which the goods are sent should always be used, to avoid loss and inconvenience.

15. Besides observing these rules for packing, consigners of goods should be thoroughly acquainted with the customs tariffs and regulations of the countries to which they are sending, as pecuniary loss and inconvenience may occur from ignorance of them. For instance, if a case contains various substances, the duties on which are different, it is usual in some tariffs to calculate the duty of the whole of the contents of the case or at least of the packing materials at the highest rate. The importance of packing together goods upon which the customs tariffs are similar is self-evident from this.

16. In cases of urgency small quantities of any substance suitable for such transmission, *e. g.*, quinine, antipyrine, salicylic acid, etc., may be sent as patterns without value, and thus avoid the delay caused by the customs office.—*C. Monheim, Chem. Zeit.*

Redevelopment of Thin Negatives.

Mr. C. F. Cooke, of Wilkesbarre, Pa., in an article received too late for insertion in the "International Annual," gives a formula for redevelopment of thin negatives, which he has used with great success, as follows:

STOCK SOLUTION NO. 1.

Mercury bichloride	80 grains.
Water	10 ounces.

NO. 2.

Iodide potass	50 grains.
Water	6 ounces.

NO. 3.

Bromide ammonium	50 grains.
Water	6 ounces.

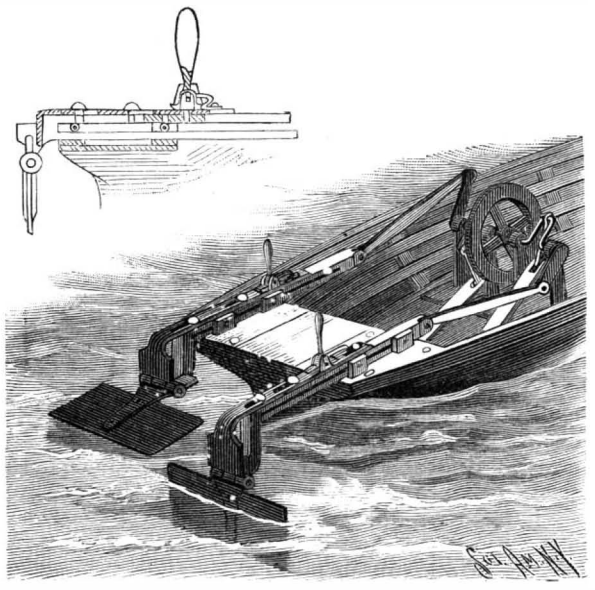
NO. 4.

Hyposulphite of soda, saturated solution, a few drops at a time, till red precipitate is just redissolved.

First dissolve the mercury, and then add Nos. 2, 3 and 4 in order. For redevelopment take of stock solution one ounce, and of water one ounce, and after thorough washing, proceed as in ordinary developing.—*Bulletin.*

A BOAT PROPELLING AND STEERING DEVICE.

By means of the attachments shown in the illustration a boat may be driven forward or backward, and readily steered, by foot power, or by the operating of a crank by hand. Affixed to each side of the stern, near the rear seat, is a keeper plate in which slides a longitudinally and horizontally slotted bar, extending out beyond the stern, each slide bar having a depending end, in which is pivoted a paddle. The paddles are secured to the slide bars by straps, which project above the pivotal point, and are adapted, as shown in the small sectional view, to engage the depending end



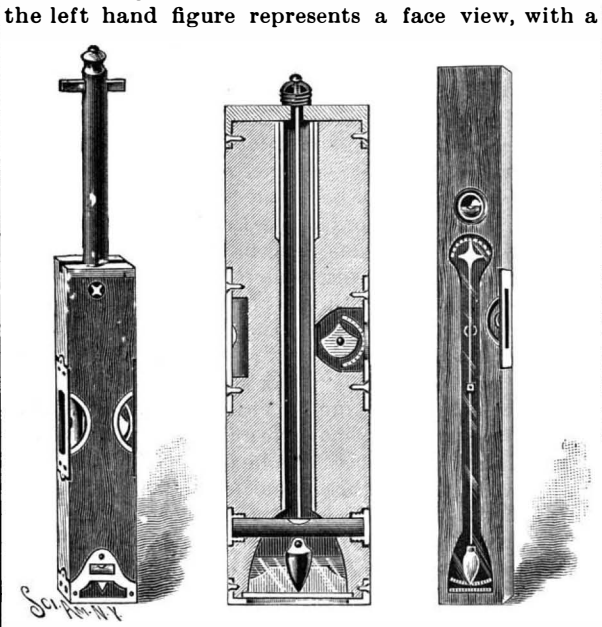
REHM & MARX'S PADDLE DEVICE FOR BOATS.

of a plate held to slide on the slide bar, by which the paddles are adjusted to move the boat forward or backward. When the plates are adjusted as shown in the large view, their depending ends are in the rear of the stops of the paddles, which will thus be held in a vertical position to push the boat ahead as they are moved backward, the paddles turning up edgewise as they are drawn forward, but when the depending ends of the plates are in front of the paddle stops, as shown in the sectional view, the paddle will operate to force the boat backward. Each adjusting plate has, near its forward end, lugs, in which a lever is pivoted within convenient reach, and by means of which the plate may be readily moved forward or backward upon the slide bar, and secured in place to hold the paddles in proper position for the forward or backward movement of the boat, or to prevent one of them from being operated at all, the latter feature affording great facility in steering the boat. The front ends of the slide bars are pivotally connected by pitmen with the cranks of shafts on opposite sides of the boat, the shafts being turned by pedals, which also turn a central shaft carrying a balance wheel, or the cranks may be arranged for operation by hand. To insure the easy working of the slide bars, rollers are arranged in the slots of the bars, by which the friction is reduced to a minimum.

Further information relative to this invention may be obtained of the patentees, Messrs. John Rehm and Ferdinand A. C. Marx, Westchester Avenue and Bronx River, New York City.

A COMBINED PLUMB AND LEVEL.

In this improved device, as shown in the illustration, the left hand figure represents a face view, with a



GARNER & CONNAUGHTON'S PLUMB AND LEVEL.

raised extension, the middle figure being a central sectional view, while at the right is shown a modified construction. The sides of the stock form straight edges, and at its lower end is a mortise in which plays an inclosed plumb bob over a glass plate provided with graduations, visible through an opening. The bob is also visible through side glasses, through which likewise may be seen a removably secured spirit level set transversely in the stock, the cord by which the bob is suspended being seen across the level. A short steadying rod projects into an opening in the upper part of the bob, to prevent its rotation and permit a limited swinging motion, and the bob cord extends up through a central recess or channel in the stock, a tubular extension being also supported to slide in the stock, through which the cord may be passed, to be secured to its cap, around which the cord may be wound when the tube is lowered into the stock. There are guide lines on the stock and on the extension, whereby the latter may be set accurately, and the extension has an arm or cross bar whose ends are in line with the straight edges of the stock, adapting the device for use on a longer surface than when the extension tube is down in the stock. At one edge of the stock is a spirit level, and in its opposite edge is a swinging gravity level, the weighted pointer of which is seated in a mortise having glass top and side plates, the latter marked with graduations. In the modified construction shown in the figure at the right, the recess for the bob cord is mortised in the face of the stock and covered by a glass plate, the suspension device being a pivoted bar having at its upper end a pointer registering along a graduated scale.

For further information relative to this invention, address the patentees, William J. Garner and Thomas Connaughton, Latourell Falls, Oregon.

Production of Copper in the United States.

Census Bulletin, No. 96, relating to copper production in the United States, has been prepared by Mr. Charles Kirchhoff, special agent, under the supervision of Dr. David T. Day, special agent in charge of the Division of Mines and Mining, of the Census Office. The report shows the United States to be the largest producer of copper in the world, its product for the year 1889 being 226,055,962 pounds, or 113,028 short tons. The total expenditures involved in this production were $12,062,180, of which there was paid in wages, $6,096,025; in salaries, $120,896; to contractors, $334,443; for materials and supplies, $4,067,970; and for taxes, rent, etc., $1,442,846, the total capital invested being $62,623,228, and the total employes, exclusive of office force, 8,721.

The copper product of the United States was as follows, in pounds, in the calendar year 1889:

	Pounds.
Arizona	31,586,185
Michigan	87,455,675
Montana	98,222,444
New Mexico	3,686,137
Colorado	1,170,053
Idaho	156,490
Nevada	26,420
Utah	65,467
California	151,505
Wyoming	100,000
Vermont	72,000
Southern States	18,144
Lead smelters and refiners	3,345,442
Total	226,055,962

During the last ten years, Arizona and Montana have made wonderful progress in the mining and production of copper, and to-day Montana, as will be seen from the above statement, leads all other States in this production, its product exceeding that of Michigan (which has heretofore been the leading producer) by 10,766,769 pounds.

American Screws in England.

Another industry, of an important character, is about to be introduced into Leeds. For some time past, says *Iron*, the American Screw Company, of Providence, R. I., has had in contemplation the establishment of a screw factory in this country, and circumstances being now favorable for the enterprise, Leeds has been selected as the industrial center offering the most advantageous conditions. An eligible site has been obtained in Leeds, viz., that of the Old Perseverance Iron Works, in Kirkstall Road. It is proposed to cover the frontage to Kirkstall Road to the extent of 100 feet, and to carry the building back for 344 feet, with a width (over the greater part of the latter) of 80 feet. When the time for extension arrives a duplicate of this building will be erected; and when this has been done, the two buildings running backward from the road will be separated by a yard 40 feet in width. The screws manufactured will be exclusively of the kind used by joiners and carpenters, and they will be of the English pattern. The machinery for the factory will come from America, and be adapted to the requirements of the trade in this country. The screws are packed in paper boxes, and these, together with the necessary labels and trade marks, will at the outset be procured from English firms; but the company intend eventually to make the boxes on their own premises, and will, in all probability, print the labels and trade marks there likewise. The finished wire used in the manufacture of the screws will also at the start be obtained elsewhere; but the scheme of the company includes the construction of wire mills and annealing furnaces alongside the screw factory.

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Nature's Fireworks at Sea.

The steamship Pathan arrived here recently from Japanese ports with the first cargo (938 tons) of summer tea. Capt. Roy reports having witnessed several remarkable meteoric showers on the Atlantic. The shooting stars were of unusual size and brilliancy. Nearly all of them looked as large as Jupiter appears to be, and at least a dozen left in the sky bright flashes that lasted from ten to twelve seconds. Some few were so luminous that they lit up the ship like electric lights. The rain of stars seemed to come from the vicinity of the Great Bear. Its course appeared to be from north to south and south-east.

On Aug. 1, just after leaving Gibraltar, the Pathan ran into an electric storm, preceded by heavy squalls. The tip of every yard arm and mast was adorned with globes of electric fire. They jumped from point to point, ran up and down the rigging, slid along the stays, ascended and descended the halliards, playing such a game of tag as Capt. Roy had never before seen in his long experience in southern seas.

THE BREEDING HABITS OF THE SKATE.

BY WM. P. SEAL.

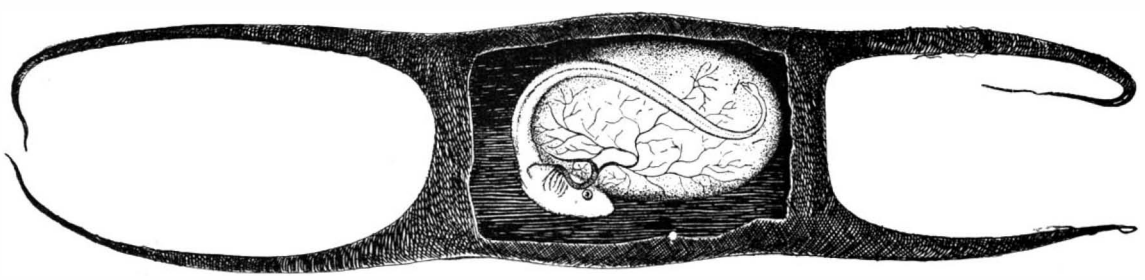
An interesting observation has recently been made in the aquaria of the United States Fish Commission, at Washington, on the common or "barndoor" skate (*Raia laevis*), which, though not complete, shows a very long period of gestation and incubation.

On November 1 last a single skate of this species was received among a lot of fish brought from the Wood's Holl station by the commission's steamer Fish Hawk, on her return to Washington. The skates do not usually live well in aquaria (in small tanks at least), but this one being not very large—about fifteen inches from tip to tip—appeared to be well satisfied with the conditions, and ate with avidity, catching small fish, or taking them from the hand of the attendant. On January 16 it laid an egg, and within a few days laid six more. It was thought at the time that as there was no male present, and it had been in the aquarium two months and a half, there was small probability of the eggs being fertilized. It was with considerable astonishment, therefore, that on May 12 the attendant, Robert Tunbers, a very observing man, found that they were undergoing development, and that by holding them up to the light the young skates could be plainly seen moving about. The accompanying sketch by Mr. H. E. Baldwin, a draughtsman of the commission, gives a very satisfactory view of the young skate at this period.

To make the drawing it was necessary to open an egg, and this was done by cutting it open on three sides, leaving one side to act as a hinge. The shell was filled with a thin but somewhat viscid fluid, in which the little skate moved freely about while the drawing was being made. When the picture was finished the egg was closed up and replaced in the aquarium. More than two weeks after this the little fish thus rudely disturbed, in the interests of science, was found to be still alive and apparently not at all the worse for it. It seems impossible that the salt water should not have found its way into the egg through the opening, and yet, on the other hand, the pressure may have sealed it up very tightly. At this point the egg disappeared, and a very interesting observation was brought to a close.

The hatching of the remaining eggs was awaited with the greatest interest. Another misfortune awaited, however, for before the absence of any of them was noticed they had all mysteriously disappeared like the first one.

This was a very great disappointment, of course, and a solution of the mystery was sought, but no trace of them was ever found. It was surmised, however, that as they had been transferred to an aquarium which had no cover over it, they were pulled out by the rats infesting the place and carried off into their holes to be eaten. As the eggs, owing to the air forced into the water, sometimes became so covered with the globules as to become buoyant and float to the surface, this seems to be a reasonable conclusion, especially as the rats are known to capture fish, snails, etc., from the tanks when opportunity offers.



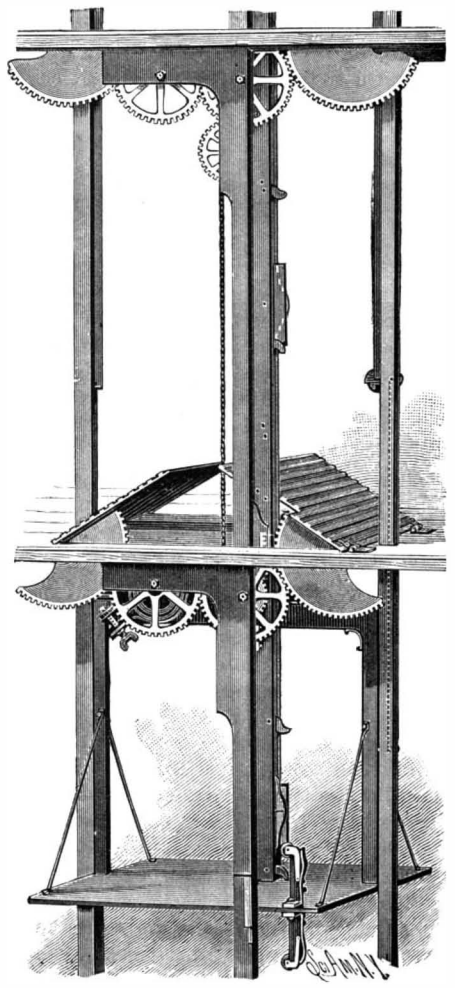
EGG OF THE SKATE (RAIA LAEVIS) SHOWING EMBRYO.

On the 16th of June, when the eggs were last noticed by the writer, the hatching was apparently still some time off. It is possible that the period covered from the laying of the eggs to their disappearance may not represent a normal development, but there may have been a retardation from some cause. It appears that but little is known of the habits of the skates.

Vinal Edwards, an observing collector of the United States Fish Commission at Wood's Holl, Mass., has found skates' eggs in great numbers on sand bars, at low tide, all standing upright, with one end buried in the sand. Those who visit the sea shores are familiar with the empty shells, which are quite common among the sea weeds and drift.

IMPROVEMENTS IN ELEVATORS.

The accompanying illustration represents various novel features of construction relative to elevator doors and means for operating them, a brake and safety devices, and other attachments, applicable to both freight and passenger elevators, and forming the subject of several patents in the United States and foreign countries, Mr. William N. Anderson, of San Rafael, Cal., being the inventor. The doors of the shaft openings are automatically opened and closed, so that there will be no draught in the well shaft, by the movement of the elevator car, which is raised by a cable attached to the top of the car frame and connected with a winding drum in the usual way. The car floor and top carries mechanism for operating the doors, which have on their under sides transverse strips aligning with the side posts, to form when the doors are open a continuous guide for the car. A cord affixed to the inner edge of each door extends over a suitable pulley, and carries at its outer end a weight or counterbalance, that the doors may be easily operated. Each door also has at one end a depending segmental rack meshing with one of two pinions depending in hangers from a floor joist across each entrance to the elevator well, the other pinion engaging toothed racks fixed to the top of the elevator car frame. The floor joist also has vertical slots in its inner side aligning with the racks on the top of the car frame, and with racks attached to the bottom of the frame, and engaging one of the sets of pinions, these slots being normally held closed by a spring-pressed plate, to prevent any draught through such opening, one of the doors also having an overlapping flange, that the elevator shaft may be at all times closed tightly, to prevent any upward draught of air.



ANDERSON'S IMPROVED ELEVATOR.

As the car ascends, the racks fixed to the top of its frame engage one of the pinions in hangers from the floor joist above, this pinion meshing with the other, and that with the segmental rack to raise the doors, which are closed, as the car continues upward, by the racks attached to the bottom of the frame engaging the pinions and actuating the segmental rack. The operation is reversed as the car descends, the doors being left closed in each case.

In the improved brake, which is designed to automatically stop the car when it exceeds a normal rate of speed, while being at all times under the full control of the operator, the brake shoes are arranged to engage the sides of the posts or guide ways of the elevator shaft. Each of the shoes consists of a block of rubber or other suitable elastic material, inclosed except on its face by a metallic casing, while the back of the casing is acted upon by eccentrics on a shaft on the under side of the carriage, a gear wheel on this shaft meshing with a segmental gear wheel on a weighted lever normally held by a catch in an inoperative position. A governor on the elevator carriage has a belt connection with a spring-pressed friction wheel traveling on one of the guide posts of the shaft, and the stem of the governor presses upon a pivoted lever connected with the catch holding the weighted lever adapted to operate the brake shoe, any too rapid descent of the elevator car causing the governor to release the catch and thus apply the brakes. A cord from the brake-operating lever also extends to the inside of the car, whereby the brakes may be readily operated by the occupant.

Among the other improvements provided for are the use of corrugated metal doors, the corrugations of one plate intersecting those of the other, the doors when open resting in recesses of the side posts, on one of which is a vertical rod having at its upper end a pivoted catch to engage and hold open the door, the catch being normally pressed by a spring on the rod, and the spring being secured to a latch projecting in the path of a block pressed outward from the cage by a spring. The doors are thus allowed to drop, in accordance with a different construction, in which pinions connected with the segmental gear are engaged by sliding racks secured to sliding bars moving vertically in a raceway secured to one of the side posts of the elevator well. The racks move simultaneously in opposite directions, serving either to open or close the doors according to the direction in which the cage is moving, and each rack-carrying bar having on its back side a projecting block with pins adapted to engage cam-shaped hooks pivoted in the raceway. The hooks are reversed for opposite bars, and are adapted to engage latches on the elevator cage, the latch being pivoted to the free end of bent arms and normally pressed forward by a spring. The latch carries on one side a roller adapted to engage rounded steps on the raceway, the pressure releasing the latches from the blocks so that the cage may move on without straining the mechanism, the steps being located on the raceway at a point opposite the blocks when the doors are in either a wide open or closed position. A gear wheel connected with one of the door racks has a loosely mounted drum within which is a ratchet wheel engaged by a spring-pressed pawl, the drum being encircled by a strap so that pressure can be brought on it to prevent the doors from slamming. A modified form of gearing is provided for use in cases where the elevator well is located against the wall of a building, the mechanism in each case being designed to work with a minimum of friction, while always keeping the elevator shaft closed against draughts.

Log Hauling Devices.

The inclined and horizontal log haul in operation at the Hudson River Pulp and Paper Company's mills, at Palmer's Falls, N. Y., consists of an endless detached chain, running in a recess at the bottom of a trough, having special links with log teeth every five feet and passing over sprocket wheels whose centers are 200 feet apart. The head wheel is 25 feet above the foot wheel. The water end of the chain swings, and can be raised or lowered by means of a small winch to suit the depth of the water. The logs are floated to the haul-up, and as they come around the foot wheel are caught on the teeth of the chain and carried up the incline at the rate of 125 feet a minute. On arriving at the top they are discharged into a horizontal log haul, having head and foot wheels nearly 600 feet apart, the whole being similarly constructed to the inclined haul. The return chain is supported by toothed idlers. A deflecting piece is placed across the horizontal conveyor, by which the logs elevated by the chain are thrown out of the trough and rolled over the side upon long skids.

The outfit has dispensed with the use of eight or ten double teams and as many men, and takes out logs as fast as they come down, preventing the accumulation that resulted under former methods. Some of the logs measure 30 inches in diameter and from 40 to 50 feet in length. The average is about three to the hundred feet. The power required is small, a 25 horse power engine being ample for the work at the pulp mill.

To polish deer horns, scrub them with a brush and sand to take off the dirt and loose fiber, then polish with rouge and rotten stone and a cloth, and varnish with copal varnish.

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TESTS OF MAGAZINE SMALL ARMS.

During the past three weeks a board of army officers, composed of Lieutenant-Colonel Robert H. Hall, 6th Infantry, president; Major George W. McKee, Ordnance Department; Major Henry B. Freeman, 16th Infantry; Captain Stanhope E. Blunt, Ordnance Department, recorder; and Captain George S. Anderson, 6th Cavalry, have been in daily session at Governor's Island, in this harbor, testing a number of magazine guns.

The Board was constituted last winter, and is required to recommend to the War Department of the army a suitable breech action and magazine system for rifles and carbines. Before ordering the Board, the department had decided upon the caliber of the proposed rifle, fixing it at 0·30 inch, instead of 0·45 inch, the old standard. It had also settled upon the length of barrel, the twist of the rifling, the number and form of the grooves, and the dimensions of the chamber, corresponding, of course, to the cartridge which had been adopted, leaving for the determination of the board only the selection of the best magazine and breech system adapted to the selected barrel and cartridge. This cartridge, which is illustrated in the accompanying engraving, has a bottle-necked shell, and, when loaded, is 3·09 inches long. The bullet is 0·309 inch in greatest diameter, about the same as an ordinary lead pencil, and has three grooves or cannulures for the lubricant; this method of carrying the lubricant, usual in the 0·45 or larger calibers, was abandoned by all foreign services in their new small caliber guns, but has been retained in our experimental army cartridge, and with very successful results.

The new bullet is a compound one, hardened lead incased in a jacket of copper. The substitution of this for the old lead bullet is rendered necessary by the vastly increased velocity now given to the ball and the rapid twist, one turn in nine and one-half inches of the rifling. A lead bullet would be driven through the bore, stripping without taking the grooves; the jacketed bullet takes them steadily. Foreign countries have selected for jackets not only copper, but nickel, German silver, and soft steel, Which will be finally adopted in this country cannot now be answered. The copper jackets fulfill all the requirements desired for these present tests, but may not, ultimately, be deemed best for war. The bullet weighs 230 grains. The charge is 36 grains of smokeless powder, which gives nearly 2,000 feet muzzle velocity, a flat trajectory, vastly increased dangerous space, or interval covered completely by the bullet in its path through the air, and an extreme range of about 4,000 yards.

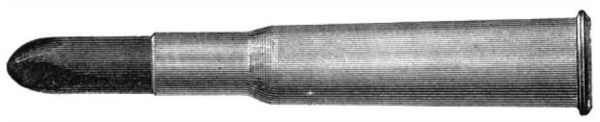
The object of the use of smokeless powder has been frequently misunderstood. The absence of smoke, the characteristic appealing most forcibly to the observer, has been popularly supposed to be the end for which military men were striving, while in fact it is only a consequence, not at first contemplated, resulting from their efforts in other directions. Briefly, these may be summarized as primarily a desire to give the soldier a lighter cartridge. Hence first came a reduction from the 11 mm. (0·433 inch) so general abroad to 8 mm. (0·315 inch) or even to 0·295 inch for the caliber, thereby giving the soldier 175 rounds of ammunition with no greater burden than 100 rounds of the 0·45 caliber service Springfield.

When gunpowder was used in these small bores, it was discovered that the fouling soon became excessive, impairing the accuracy of fire to an impermissible extent. The nitrate powders were then resorted to, where the products of combustion are entirely or mainly gaseous, the solid or unconsumed residue being very small. These overcame the objectionable fouling, gave a much superior velocity, and are almost without smoke, only a slight puff being noticeable, and that dissipates almost immediately. They give, however, a formidable chamber pressure which requires an increased strength, not only in the barrel, but in the breech action of any gun using them.

The smokeless powder used by the Magazine Gun Board comes from Wetteren, Belgium, and the cartridges are loaded at Frankford Arsenal, Philadelphia; the powder is sufficiently near the desired standard to suffice for the tests of the Board, but its use now cannot be considered as a definite adoption into our service.

The Board first met last December and adopted the rules to govern their tests, under which they have since operated. These tests are applied in the endeavor to discover the relative performance of the breech action and magazine system of various guns, under such conditions as might arise in service in the vastly diversified circumstances throughout our great extent of country, and under both slow, rapid, and also prolonged firing. No trials of the accuracy of the guns are made, as accuracy is mainly influenced by the barrel and the cartridge, elements already decided upon, and not within the province of the Board for discussion or experiment.

Guns are brought before the Board by the inventor or his representative and their action exhibited by him, after a safety test of ten rounds fired by the exhibitor. The gun is then turned over to the Board, and they only conduct the further trials. The first of the regular tests is that for rapidity with accuracy, exemplified by our sketch made of the work as it was in progress. The range is but 100 feet, the condition of accuracy being only so far introduced as to require the operator to bring the piece to the shoulder after loading. The test is in three parts, first using 20 cartridges;



THE NEW AMERICAN CARTRIDGE (ACTUAL SIZE).

the magazine having been filled with the cartridges it will hold, the balance of the 20 are fired from the gun as a single loader, then the magazine brought into action and its cartridges fired; both the time and the number of hits are entered on the record. The second part of the test is the rapidity of fire for two minutes as a single loader; the third part, the rapidity of fire, that is the number of shots for two minutes as a magazine arm only.

The second test is for rapidity at will; it is similar to the preceding, except that the piece is fired from the hip without aim at a stop butt at short range. These rapidity tests are, of course, somewhat influenced by the dexterity of the individual manipulating the piece. For this purpose the Board makes use of the often tried services of Mr. R. T. Hare, of the National Armory, Springfield, and of its recorder, also stationed at the armory, and who is well known throughout the army and militia as the author of the manual on rifle practice governing in the army and in the National Guard of many States as well. Men more expert than these two in the handling and use of small arms it would be difficult to find.

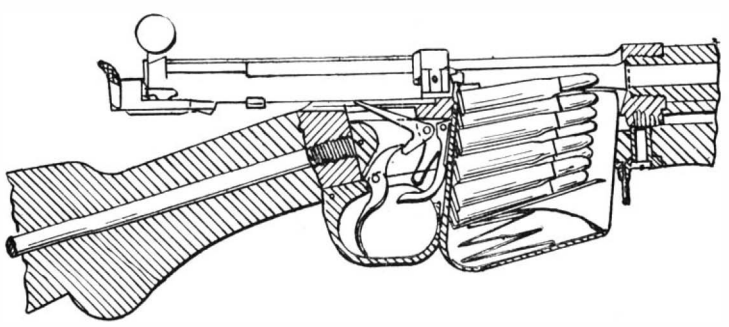
Following the rapidity tests come those for endurance—500 rounds without cleaning as a magazine gun and 100 as a single loader, keeping the magazine loaded during the latter firing and examining at its conclusion the effect upon the cartridges thus held in reserve. In the endurance test, to relieve the manipulator of the gun, it is fired from a fixed rest in which it is securely held, but the breech action is operated by the firer and the comparative ease of movement noted. Every fifty shots the piece is removed from the rest and the barrel cooled by running a stream of water through the bore, care being exercised not to get any water upon the bolt or into the magazine.

Then comes the dust test. This is intended to subject the piece to the same dusting it would receive if carried by the soldier in a march across the alkali deserts of Arizona or Utah or the sage brush prairies of Montana or Wyoming. Members of the Board told our correspondent they had frequently been compelled to tramp for hours through such clouds of dust that the heads of the leaders of a six-mule team could be but vaguely seen from the wagons, and that the dust was so fine and penetrating that the soldiers' guns and every garment soon became coated with it. The artificial production of a similar experience for an arm that might be adopted for military service in our country is manifestly a very pertinent trial, and one necessary for the formation of a trustworthy judgment of the arm. This is accomplished by placing the rifle on a shelf of the closed box shown in our engraving, so that the breech mechanism, which is closed, shall be opposite the mouth of the bellows; fine sand is then permitted to fall slowly across the blast of air, which thereby, in two minutes, the time of the test, drives the sand into any open joints, or into the depth of the mechanism if it is much exposed.

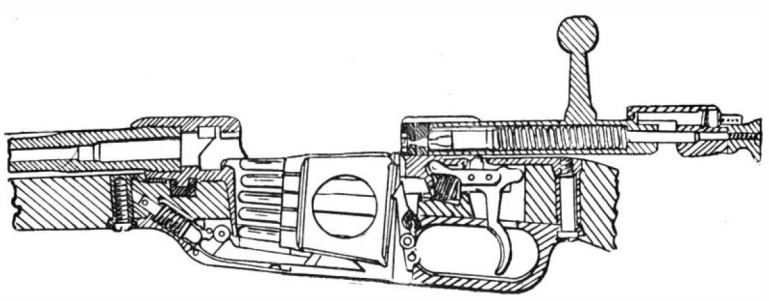
The gun is then removed and wiped carefully with the bare hand only, also blown into and cleaned just as a soldier, who suddenly goes into action, would do with a gun he had carried on a dusty march. The piece is then fired 20 shots. This test is then repeated, the magazine being charged before exposing the gun to the dust; the cartridges and the gun are then wiped as before and the gun again fired 20 rounds. The dust test, while certainly a fair one, is a severe trial to many guns. Any little pockets hold the dust and prevent smooth action of the mechanism, even in some cases that have come before the Board so completely clogging the action as to temporarily disable the gun and make necessary its entire dismounting at leisure.

The next test is that for defective cartridges. This is devised to exhibit the effect on the breech and magazine system of the blowing off of a cartridge head, an accident which, while not frequent, is by no means unknown. The cartridge head is first given two cross cuts on the head to nearly the thickness of the metal and the cartridge so placed in the chamber that the cuts shall fall near or under the extractor. One engraving shows this test in prosecution, the gun being on the fixed rest and fired by a lanyard—a wise precaution, as the bolt is sometimes violently opened, or parts broken. A second defective cartridge is also fired which has been cut at intervals around the rim. The effect is very similar to that of the first.

THE AUSTRIAN (MANNLICHER) MAGAZINE RIFLE.



THE NEW ENGLISH MAGAZINE RIFLE.



THE GERMAN MAGAZINE RIFLE—MODEL OF 1888.

Rifles that pass successfully through these trials are subjected to the supplementary tests, the first a combination of the dust and defective cartridge trials and the second the rust test. The first page engraving shows the latter, the operator being in the act of placing the gun, which has first been carefully and thoroughly cleaned of all oil or fouling with a bath of sal-ammoniac. It is then removed, left for two days in a warm dry atmosphere, when the condition of the mechanism is examined and the gun fired twenty shots. This test is intended to produce artificially the condition to which a gun might be brought that had been inadvertently left outside the soldiers' tent during an all-night rain.

Other tests are also applied, especially to guns with tubular magazines, and to any other guns whenever the Board deems it necessary to aid in forming their judgment.

Shortly after it was convened the Board instituted steps to procure from abroad samples of the magazine guns which had recently been adopted in foreign armies. These have been presented to our government, and the new weapons of England, Denmark, Germany, Austria, Belgium, and Portugal have already been thoroughly tested by the Board, while those of Switzerland, Japan, Russia, and Italy will soon be subjected to trial. France was unwilling to have her gun subjected to trial.

As yet but few guns of our own inventors have been brought forward, though from the extensive correspondence of the Board, some are anticipated at an early day. The radical reduction of bore, the use of a long and slender cartridge and the increased strength of breech action necessitated by the employment of smokeless powder have all operated to so complicate the problem as to require more time than first imagined for its solution.

The Board, acting under instructions of the War Department, have assured all inventors that they will be granted ample time and their work carefully examined, even if its production is delayed. The Ordnance Department, too, sells inventors caliber 30 barrels for guns and smokeless powder caliber 30 cartridges for their preliminary trials, or if they prefer it caliber 30 bullets and primed shells. A number have availed themselves of these opportunities, and presumably will, at a later date, bring forward guns for trial.

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Of those foreign guns already tested by the Board, cuts are herewith shown of the Lee-Speed of England, the infantry rifle of Germany and the Mannlicher of Austria. The first of these, the Lee-Speed, is a modification of the Lee of this country. It was sent to our government with a supply of cartridges for its use. The caliber of the gun is 0 303 inch; the bullet is of lead, nickel jacketed, and weighs 216 grains. It is thus of slightly greater diameter but of less length and weight than the new American bullet. The powder charge is intended to be Maxim's smokeless cordite, from which a velocity of 2,250 feet is anticipated. The drawing shows the magazine—which when full holds eight cartridges—partly emptied and a cartridge ready to be pushed by the bolt into the chamber. The magazine is of sheet metal and is of the semi-detachable type, being secured to the lower band by a chain. It can only be charged with single cartridges, an operation which requires some time, but holding the large number of eight, permits of a very rapid fire for that number of shots. In modifying the Lee the English introduced many little refinements which promised well on paper, but which use in the field in the soldier's hands has not justified. A second sample, returning, it is understood, more nearly to the simplicity of the Lee itself, is now being prepared by the English authorities. In this country the Lees themselves are, it is believed, adapting two of their guns to the American 30 caliber cartridge, and these guns will soon come before the Board, which is anxious to study and try them.

The German infantry rifle, termed model of 1888, is of 0·311 caliber and has a fixed magazine. The cartridges are carried by the soldier in light metal chargers, which are introduced bodily into the magazine and form an essential feature of its mechanism. Each holds five cartridges, and after they are fired falls to the ground through a cut in the magazine box, permitting the introduction of a second charger with its lot of five cartridges. Unlike the Lee, which can be used either as a single loader or magazine gun, or as the former with eight cartridges in the magazine in reserve, the German weapon, having no cut-off, is a magazine arm pure and simple, being only intended for that class of fire. Fortunately the magazine can be quickly recharged, yet the soldier cannot tell when he will be compelled to perform that operation, nor whether he has five cartridges or only one immediately on hand for rapid fire.*

Both the Lee-Speed and the German weapons are bolt guns, the bolt having a forward and back motion, and also one of rotation by which it is locked in position, but the new Austrian arm, the Mannlicher, † possesses the peculiarity of direct action only, a falling block locking the gun when the bolt is pushed forward. This feature, which eliminates one motion of the loading, also permits fire for the contents of the magazine to be maintained directly from the shoulder without lowering the piece during the operation of loading. A very rapid fire for these cartridges therefore results.

The inventors of the Krag-Jorgensen gun, adopted by Denmark, are preparing an arm of 0·30 caliber arranged for the American cartridge. As the results of the trial of the Denmark gun itself at Springfield last spring were quite encouraging, much is anticipated in this expected weapon. Several other guns are also in course of elaboration abroad, which will soon come before the Board. But the Board looks mainly to the well known ingenuity of American inventors, and hopes before winter to be testing the product of their labors, and to discover thereby a weapon superior to those of all foreign armies. Both the Board and the Ordnance Department of the army express the greatest desire to aid as far as practicable native talent, and inventors can freely turn to the Board for suggestions or information concerning the pending work and the prospects for a successful termination of their joint labors.

Trials of guns on hand were completed last week, and the Board has adjourned to meet at the Army Building in this city, on September 15, when tests will be resumed. In the interval, any correspondence should be addressed to the Recorder, at the National Armory, Springfield, Mass.

Superstition.

Superstition, like prejudice, is impervious to logic, and no argument addressed to the reason has any effect upon its power or prevalence. Why is thirteen an unlucky number? What possible connection has the assemblage of thirteen persons at dinner with the death of any one of them during the ensuing year? If fourteen dined together, there is certainly a greater chance that one of them would pass away within the twelvemonth than if one less sat at the table, and yet this is not the common estimate. There is not a housekeeper in this city who would seat thirteen at her table without a feeling of regret, and the great majority would not entertain a company composed of that number for any consideration whatever.

We recall an instance where a family given to a liberal hospitality had a dining table which seated six on either side and one at each end. Once every week a dinner was given to which twelve guests were invited, the host and hostess occupying the other seats. If one of the persons invited sent a regret a substitute was sought for and secured if possible. But failing in this, a young woman, a poor relative with pleasant manners, living in the family, took the vacant chair, and was supported in the house for no other purpose than to meet this possible need. There have been "Thirteen Clubs" organized to relieve the number of its reputation, but they have utterly failed of their object. We cannot find that those who thus braved the common superstition were cut short in their days on this account. But people cannot insure themselves against the fatal blow, even by a display of unusual courage, and the ranks of the thirteen were broken sooner or later by the assault which none can successfully resist.

There are scores of superstitions connected with the moon and its phases. The effect of the "changes" on the weather is a matter of almost universal belief, although the most renowned of our scientists have agreed with Dr. Ick and the celebrated Dr. Lardner that "there is not the slightest observable dependence between them." There is probably not a person in the country who would not, if he had his choice, prefer to catch the first glimpse of the new satellite over his right shoulder, while large numbers are rendered quite miserable if they happen to see the narrow crescent on its first appearance over their sinister side. The prev alent impression that Friday is an unlucky day regulates in many respects the business of the world. Those who are ready to assert that they have no feeling whatever on the subject are very careful in solicitation of patronage for any new enterprise, or in choosing the date for an entertainment or a marriage, not to run counter to this popular fallacy.

Some years ago an English shipowner, finding that none of his vessels could get off to sea on Friday, owing to the feeling among the sailors, determined to cure the madness if he could. He therefore laid the keel of a vessel on Friday, made every contract concerning the construction on Friday, and launched the craft on the unlucky day. He christened the ship with this name, and found an old sea captain called Friday whom he made master for her first voyage. She was loaded for an East India port, and after great difficulty in securing a crew she sailed on a given Friday for her destination. She was never spoken or heard from after the pilot left her. The presumption is that when she encountered her first storm, the sailors, who are proverbially superstitious, became apprehensive and took to the boats, leaving the ill-fated craft to founder in midocean and to perish themselves in like manner. It is singular how one such incident will deepen a prejudice already existing and establish in the minds of many, who are otherwise sensible, a connection between two events that can have no possible relation to each other.

Two years ago, it is said, a woman afflicted with catarrh visited the Manhattan Eye and Ear Hospital, to be treated for her illness. Dr. Johnson, who at that time had charge of Cabinet D, treated the case, and two days afterward he suddenly died. The patient was relieved by the treatment, but six months from the first date, on a return of the malady, she again sought the institution. Dr. Pond, then in charge, attended her, and in two days after he died of heart failure, as the record states. A week or so ago she again applied for treatment, and Dr. David Phillips prescribed for her. He dined the same day with a friend, went home not feeling very well, and was found dead in his bed the next day. Whereupon the story is published far and wide, and the poor woman is set down as "The Fatal Patient," whom it is dangerous for any physician to treat. Any yet no person of ordinary intelligence would see anything very remarkable in the coincidence described.

The original "weather prophet" (Mr. E. Merriam) used to print his "cycles" and "heated terms" and "perturbations the sure sign of earthquakes" in this journal during the administration of Gerard Hallock, nearly fifty years ago, and the present editor-in-chief, too young then to be very patient with people of such vast pretensions, was disposed to make fun of the predictions. One day, to establish the truth of his prognostications, the "Brooklyn Sage," as he was often called, produced a book in which he had recorded as in a diary his presages of the weather, including predictions of storms, earthquakes, and special atmospheric disturbances. Mr. Hallock had kept in a drawer the clippings descriptive of all such phenomena, and he was challenged to produce them, and see if they had not been foretold and the account anticipated in this daily record. There were no telegraphs and ocean cables to give instant notice of such occurrences, and if the writer in Brooklyn put down under date of March 4, "perturbation—probable earthquake in South America," or "signs of a hurricane in the China seas," and the slow mail a month or two later brought an account of such upheavals or disaster, the skill of the observer was firmly established. Sure enough, the volume stood the test in a most remarkable manner. Out of twenty-three actual "shakes" in some part of the world, twenty were predicted in the book at the corresponding date. Out of seventeen fierce storms, notable for the damage they had caused on land or sea, fifteen had been predicted. The old man closed his book with an air of triumph, and the veteran editor uttered his mild rebuke of our incredulity.

We remembered the saying of an old scientist who ridiculed the faith in dreams, and was asked if none of his ever came true. He answered that in a long life he had waked with the remembrance of over 30,000 dreams. Of these only five came true, and the connection therefore failed for want of evidence. It occurred to us to test the book on its other side, and see how many predictions had been made that had no counterpart in history. So we seized the volume, and fortifying ourselves behind a desk, we turned its pages. Our suspicions were fully verified. There was hardly a day in the whole year in which some atmospheric disturbance was not plainly predicted, so that a disaster could hardly come amiss to the plethoric volume. If twenty of the twenty-three actual earthquakes found a heralding in the book, there were at least 300 heraldings that had no actual following. If fifteen of the seventeen storms were of previous record, there were ten times that number bespoken in the book that put in no appearance. The credit of the prophet went down to zero under that exposure. It is the exceptional coincidences that give birth to the prevalent superstitions and keep them alive in the popular faith.—*American Analyst.*

The Codfishing Banks of Bristol Bay, Alaska.

From the preliminary report of Lieutenant-Commander Z. L. Tanner, U.S.N., given in the Bulletin of the United States Fish Commission, we learn that the codfish banks of Bristol Bay extend from Unimak Pass, along the Bering Sea shores of the island of that name and the Alaska Peninsula, to Cape Chichagof, and thence to the Kulukak Ground and the vicinity of Cape Newenham.

Slime Bank extends from Northwest Cape of Unimak to the vicinity of Amak Island, embracing depths from 20 to 50 fathoms. It is about 85 miles in length, 17 in average width, and covers an area of 1,445 square miles.

The bank received its name from the fishermen on account of the number of medusæ or jelly fishes found on it. Codfish of fair size and good quality were very plentiful over the whole bank, and scattering specimens of small halibut were taken.

Baird Bank has been named by the writer in honor of the late Prof. Spencer F. Baird, the first U. S. Commissioner of Fish and Fisheries, through whose untiring efforts the great scheme of deep sea fishery investigation was inaugurated. This bank is the largest and most valuable of the fishing grounds yet discovered in Bering Sea. Commencing in the vicinity of Amak Island, it stretches along the coast of the peninsula to Cape Chichagof, 230 miles, with an average width of 40 miles, and thus covers an area of 9,200 square miles.

Well equipped fishing vessels can anchor anywhere on Baird Bank and lay out such winds as they would be likely to encounter during the summer months.

We found codfish in great abundance and of good quality over the whole bank, but the best fishing ground is without doubt in depths between 25 and 40 fathoms, and the Port Moller region is the most prolific.

Codfish have their enemies in Bering Sea as well as in other parts of the world. Many wounded fish are seen, particularly in spring and fall, after the passage of the seals into and out of the sea. This phenomenon is observed more noticeably near the passes between the Aleutian Islands. Bering Sea also suffers, in common with other prolific grounds that are not much fished upon, in that numbers of fish are left to die of old age or other natural causes. At a certain age the fish become weak and more liable to be infested with parasites, all of which is soon apparent from the general condition of the victims. This is a trouble which decreases, however, as a bank becomes more generally fished.

Scattering specimens of small halibut of fine quality were found on Baird Bank. Flounders of several species, some of them excellent fish, were also taken in the beam trawl wherever it was lowered in Bering Sea.

Seasoning of Timber.

Oak timber loses about one-fifth of its weight in seasoning, and about one-third its weight in becoming dry. Gradual drying and seasoning are considered the most favorable to the durability and strength of timber. Kiln drying is particularly serviceable for boards and pieces of small dimensions, and unless performed slowly is apt to cause cracks and impair the strength of the wood. If timber of large dimensions be immersed in water for some weeks, it is improved, and is less liable to warp and crack in seasoning.

*This gun is fully described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 783, January 3, 1891.

†This gun is described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 798, April 18, 1891. The English, French and German rifles were illustrated in SCIENTIFIC AMERICAN, November 22, 1890.

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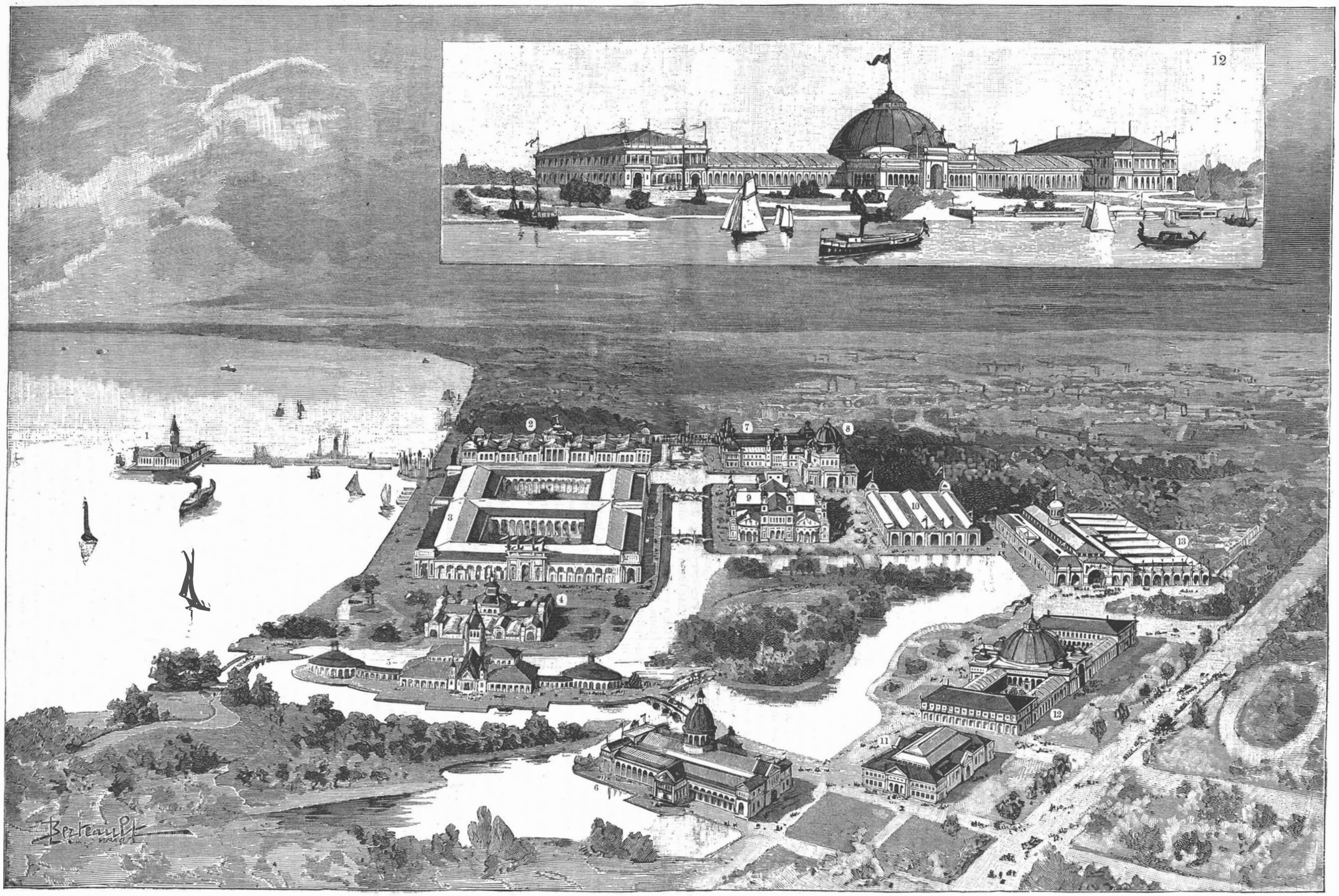

1. Casino and Pier. 2. Agriculture. 3. Manufactures and Decorative Arts. 4. U. S. Government. 5. Fisheries. 6. Illinois State Building. 7. Machinery Hall. 8. Administration. 9. Electricity. 10. Mining. 11. Women's Building. 12. Horticulture. 13. Transportation.

THE WORLD'S COLUMBIAN EXPOSITION, CHICAGO, 1893—BIRD'S EYE VIEW.

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ALBERT BENJAMIN PRESCOTT.

Thirty-seven years ago, the American Association for the Advancement of Science held its eighth meeting in Washington. During the last week in August, for a second time in its history, this, the greatest of our scientific societies, meets in the capital city of the Union. Then its members were a thousand, and now they are more than double that number. As the years have come and gone, we have reported its peripatetic gatherings in these columns, and have given brief sketches of the distinguished men who have presided over its deliberations. An unwritten law of the association provides that the selection of its chief officer shall pass from a representative of the physical sciences to one of the natural sciences and then back again. In 1888, Powell, the geologist, succeeded Langley, the astronomer, and later, Mendenhall, the physicist, gave place to Goodale, the botanist, who, at the present meeting, will yield the chair to Prescott, the chemist.

Albert Benjamin Prescott was born in Hastings, N. Y., on December 12, 1832, and is of the ninth generation from John Prescott, of Standish, Lancashire, England. The latter served under Cromwell at home, and in 1640 came to Boston. Afterward he settled in Lancaster, Mass., and was active in the war against King Philip. His grandson was Col. William Prescott, who commanded the American soldiers at Bunker Hill, and of whom it is said that in reply to a question of Gen. Gage as to who he was, the answer came: "That is Col. Prescott. He is an old soldier, and will fight as long as a drop of blood remains in his veins." Gen. Oliver Prescott, who saw much military service during the revolution, was a brother of his, and his grandson, William H. Prescott, is distinguished for his famous historical works.

The career of Professor Prescott shows him to be a worthy descendant of so renowned an ancestry. His early education was obtained by the aid of private tutors, from whose care he passed to the University of Michigan and there was graduated from its medical department in 1864. The civil war was then in progress and he at once entered the United States Volunteer Service as assistant surgeon. He had charge successively of Foundry General Hospital in Louisville, Ky., and of General Hospital No. 16, in Jeffersonville, Ind., and served meantime, during 1864 and 1865, as a member of the board of examination for appointment of surgeons in Louisville.

In 1865, at the close of the war, he returned to Ann Arbor to accept the place of assistant professor of chemistry and lecturer on organic chemistry in the University of Michigan, and five years later was made professor of organic and applied chemistry and of pharmacy. Meanwhile in 1868 the School of Pharmacy was organized and charge of its instruction was at once given to Professor Prescott, and since 1876, when the school was made a distinct department of the University, he has held the office of Dean of its Faculty. Until about 1880 the greater portion of the special and practical pharmaceutical instruction, including the laboratory work, as well as the lectures, was given by him personally. During this period nearly 140 contributions of original investigations, representing work done by the students and graduates of this school, were published in various technical journals. All of these researches were made under the supervision of Professor Prescott.

At present his personal teaching is confined to organic chemistry. In this subject he begins a course of lectures to students in science in the first semester and a course to medical students in the second semester. He also gives a course of lectures on organic analysis and one on organic synthesis during the second semester; besides which he has charge of the original investigations in operation in the chemical laboratory, which is used by the students of all the departments of the university. Since 1876 he has been professor in charge of this laboratory, and since 1884 with the special title of Director of the Chemical Laboratory.

The researches conducted in the chemical laboratory under his direction have been published, with the title of "Contributions from the Chemical Laboratory of the University of Michigan." During 1875–78 they appeared in the *American Chemist* and *Chemical News;* in 1880 in the *Journal of the American Chemical Society* and the *American Chemical Journal;* and in 1883 and 1884 as separate publications in association with Professor Victor C. Vaughan. The latter are octavo pamphlets, averaging fifty pages each.

While Professor Prescott is distinctly a chemist, still his investigations have naturally been in the direction of the application of his chosen service to that of pharmacy, and much of the work executed under his eye has been published in the *American Journal of Pharmacy.* During 1876–78 portions of this work appeared with the title of "Contributions of the School of Pharmacy of the University of Michigan," but since then they have been published with separate titles.

He has been very active in the work connected with the revisions of the "Pharmacopœia of the United States." He served as a member of the revision of that work in 1880, when he was made chairman of the sub-committee on descriptive chemistry, and furnished the assay methods for opium and cinchona, as well as the body of volumetric tests, which in that revision appeared for the first time. The general introduction of qualitative test limits, to fix the quantitative standards of medicinal purity of the chemicals of the Pharmacopœia, was first undertaken in this country by his sub-committee.

In connection with the revision of the Pharmacopœia in 1890 he has also shown considerable activity, and prepared an "Index of Contributions from the Michigan State Pharmaceutical Association, and the School of Pharmacy of the University of Michigan," to aid the national committee. It covers the time between the years 1883 and 1890, and includes over ninety papers that represent work done under his supervision in the School of Pharmacy. Professor Prescott has been an active member of the Michigan State Pharmaceutical Association since its organization in 1883, and in 1886 contributed to its "Proceedings" an "Outline of a Plan of Study for the Assistant in Pharmacy," which has been extensively circulated in reprint form in response to a continuous demand for it.

Among his more popular contributions to current scientific literature are papers on "The Material Resources of Life;" "The Aromatic Group in the Chemistry of Plants;" "The Chemistry of Coffee and Tea;" "The Chemistry of Fruit Ripening;" "Nostrums in their Relation to Public Health;" and "Poisons and their Antidotes." The foregoing are a few of the titles that have appeared in *Popular Science Monthly, Pharmaceutical Journal and Transactions,* "Proceedings of the Michigan State Board of Health," and Wood's "Household Practice of Medicine," and he has also written for other more technical journals, such as the London *Chemical News* and the *Engineering and Mining Journal.*

A contemporary of his has well said: "His writings inspire respect for their author, for they are always important, thorough, and conclusive in their scope."

His text books are well known, and include "Qualitative Chemical Analysis," with Silas H. Douglas (Ann Arbor, 1874; fourth edition with Otis C. Johnson, New York, 1888); "Outlines of Proximate Organic Analysis" (New York, 1875); "Chemical Examination of Alcoholic Liquors" (1875); "First Book in Qualitative Chemistry" (1879); and "Organic Chemistry: A Manual of the Descriptive and Analytical Chemistry of Certain Carbon Compounds in Common Use" (1887).

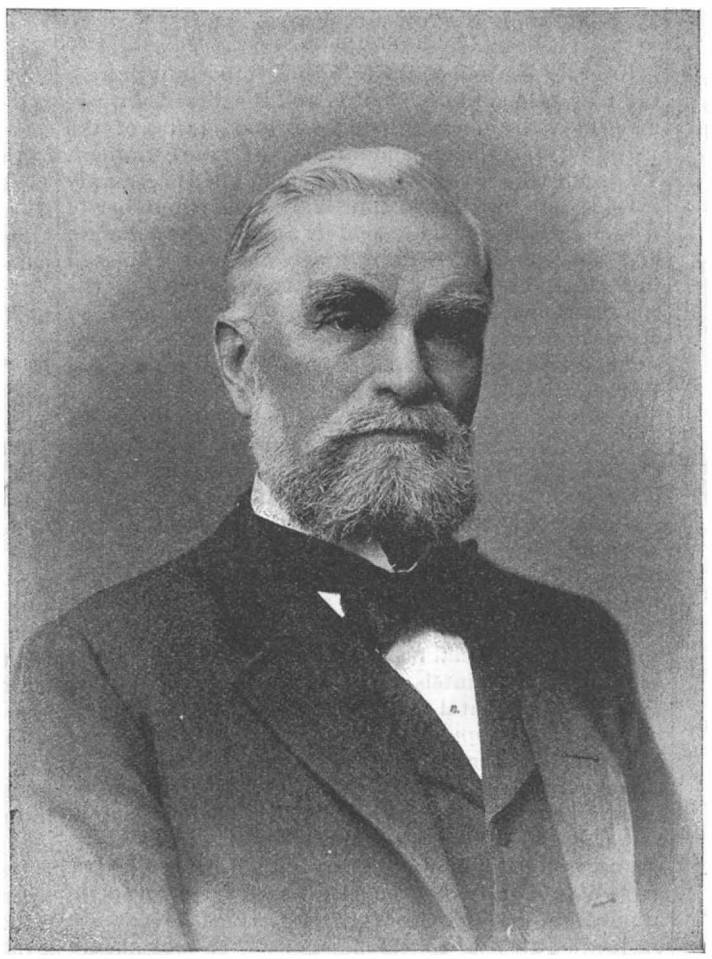
The last named, which is his largest work, is undoubtedly the most complete and valuable book on the subject that has as yet been written by an American chemist.

Besides his degree of M.D. taken in course, he has received that of Ph.D., and in 1876 he was elected a Fellow of the London Chemical Society. He early joined the American Chemical Society, and in 1886 was chosen president of that body.

In the movement which was started several years ago, at the meeting of the Chemical Section of the American Association, for the purpose of organizing a national chemical society, he has been very prominent, and his influence has been potent in producing the conservative feeling that has marked the meetings that have been held.

In 1874 he was elected a member of the American Association for the Advancement of Science at its Hartford meeting, a year later he was advanced to the grade of fellow, and in 1887 he presided over the chemical section at the New York meeting. His retiring address on this occasion was entitled "The Chemistry of Nitrogen as Disclosed in the Constitution of the Alkaloids."

In personal appearance, Professor Prescott is rather tall, and a man of pleasing presence. He moves his audiences with a sweet persuasive way that is irresistible. His expressions are apt and to the point, while his manner commands attention. He is never obtrusive, but his advice is eagerly sought, and many of the graduates of the School of Pharmacy owe their success to his wise counsel.



ALBERT BENJAMIN PRESCOTT.

Another Navy Vessel under Contract.

By the 1st of August, 1893, the Philadelphia shipbuilding firm of William Cramp & Sons has contracted to deliver to the government one of the most important of the ships thus far designed for our navy, at present known as cruiser No. 13. Proposals for the building of this vessel were invited by the navy department several weeks ago, and the bids received were, Union Works, San Francisco, $2,793,000; William Cramp & Sons, $2,745,000; Bath (Me.) Shipbuilding Works, $2,690,000. The latter firm could not, however, complete the vessel in the contract time of two years, and William Cramp & Sons agreeing to reduce their bid by $55,000, were awarded the contract.

The new vessel will be in almost all respects similar to cruiser No. 12, now being built by the Philadelphia firm, and which Secretary Tracy has styled as being "absolutely without parallel among the war ships of the world." She is to be primarily what has been designated as a "commerce destroyer," in contradistinction to the heavy armored battle ship, and is designed for a sustained speed of twenty-one to twenty-two knots an hour, with engines to indicate 20,500 horse power. She will have a coal-carrying capacity of 2,000 tons, and be able to steam around the world at a ten knot rate. Perhaps her most novel feature will be her three screws, one placed centrally, as in ordinary single screw vessels, and two others a little forward of this screw, one on each side, in slightly recessed portions of the stern of the vessel. The center screw will be about 4 ft. 6 in. below the other two.

The principal dimensions are: Length on mean load line, 400 ft.; extreme breadth of beam, 58 ft. 2¼ in.; depth of hold from top of main deck beams to inner bottom, 29 ft. 1⅝ in.; displacement, 7,350 tons. There will be eight main double-ended boilers, in four watertight compartments, and two single-ended auxiliary boilers on the berth deck, the air-tight fire room system of forced draught being used. All the boilers are of steel, and their working pressure will be 160 pounds. There will be three sets of triple expansion vertical inverted cylinder engines. The cylinders are of 42, 59, and 92 inches diameter respectively, and the stroke (common) is 42 in.

The vital portions of the vessel will be protected by a sloping armored deck 4 in. thick near the sides and 2½ in. thick in the middle, the space beneath being divided into coal bunkers. There will also be a 5 ft. wide coffer dam next the ship's side for its full length, to be filled with woodite or a similar water-excluding substance. The battery is designed to consist of one 8-in., two 6-in., and twelve 4-in. breech-loading rifles; sixteen 6-pound and eight 1-pound rapid-firing guns, four Gatling guns, and four torpedo launching tubes.

A premium will be paid by the government of $50,000 for every quarter of a knot of speed made by the vessel over twenty-one knots per hour, and $25,000 will be deducted from the contract price for every quarter of a knot she falls below this rate. If she should not be completed within the limit of time of the contract, $75 a day for the three months next succeeding the period of limit will be deducted; $150 a day during the second three months, and $200 a day penalty after that time.

To take grease out of white marble, apply a little pile of whiting or fuller's earth saturated with benzine, and allow it to stand some time. Or apply a mixture of 2 parts washing soda, 1 part pumice stone, and 1 part chalk, all first finely powdered and made into a paste with water; rub well over the marble, and finally wash off with soap and water.

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Shoring and Underpinning Buildings.*

The essential object of shoring is to afford temporary security to dangerous buildings by arresting unsafe displacements, or to afford temporary support to buildings abutting on those which have to be taken down and rebuilt, or raised and underpinned with additional stories underneath them, or moved away to another site, or abutting on those which from their mere dangerous character require to be demolished. If there is no immediate prospect of the re-erection of buildings thus removed, the shoring should be of a more permanent character.

PHOTOGRAPHS OF SHORED BUILDINGS.

An essential preliminary proceeding to the actual work of shoring preparations in important cases is to photograph the elevations of the abutting buildings, and make written notes and sketches of details, careful measurements, and all essential particulars by which any observed peculiarities and phenomena relating to or explaining the precise character and condition of the building may be distinctly understood. All such observations should be put together in a convenient form, to be readily available for evidence in the event of litigious proceedings arising in which these facts would be important. It may also be desirable to photograph exposed division and party walls after the adjacent building has been demolished or removed, as it would be serviceable if deep excavations require to be made for deepening basements or obtaining sub-basements, cellars, or removing ballast, sand, or for any other purpose which would disturb the adjacent or subjacent soil.

ABUTTING SUPPORT OF ADJOINING BUILDINGS.

In making excavations for foundations, basements, cellars, sub-basements, drains, or for the purpose of obtaining sand, ballast, etc., the removal or weakening of the abutting natural support of adjoining buildings renders the offending party liable for consequential damages by accident or failure of party walls thereby, and hence for neglecting to apply adequate shoring and skillful underpinning.—"Miller *v.* Long," January, 1890. Judgment for $325, with costs.

DETAILED SURVEY OF EVIDENCES OF DANGEROUS SUBSIDENCES.

In practice it is essential to make a careful survey of the evidences of danger, as these may be manifested and can be estimated from the nature and condition of the materials of the parts of the building affected by unequal subsidences or displacements, ruptures or bulgings. The state of decay or other visible evidences of deterioration or dilapidation should be noted, especially anything of an insidious character which may ultimately tend to disastrous consequences. Faulty work, as well as materials, should be detected, and the characteristics noted. The statical condition of the masses of the ruptured walling, as they at present exist, should be considered in relation to the probable effect of the action of the shoring to be erected should displacements continue. The physical effect of the operations connected with the new erections to be built on the premises, in disturbance of the present equilibrium, should not be overlooked, such as pile driving, quarrying and blasting operations, drainage works or the escape of ground waters, the excessive sinking of more ponderous buildings erected on adjacent sites.

PRACTICAL DISPLACEMENTS—VERTICAL AND HORIZONTAL.

If there be any unequal displacement of portions of walls or of features, etc., of buildings, the comparative locations and directions of such displacements should be distinctly noted, with a statement appended of any special provision which may be needed for effecting its replacement or protection, or the arrest of the displacements if of a progressive character.

OVERHANGING WALLS.

If the displacement be in the nature of the wall overhanging its base, and that it is intended to be brought back to the plumb, the needling which is resorted to must be placed low enough to include above it all of the displaced portion, and then a pressure as nearly horizontal as possible is brought against it at an effective point; at the same time wedges of slate and a rather quick-setting cement should be ready for wedging up the horizontal joints of the brickwork, which have been opened by the operation of plumbing up the overhanging portion. The overhang is often irregular in different portions, and hence the treatment with needling and wedging must be adjusted to the variations needed for effecting the straightening also.

IRREGULAR SUBSIDENCES.

When irregular subsidences have taken place in consequence of the difference of weights in the bays and pier portions of fenestrated walls, or produced by difference of heights in the bays and piers, or difference of massiveness, or difference in the bearing power of the soils at different points of the foundations, and that the wall at different parts requires to be raised to reach the normal level—for this purpose needle holes must be cut through the wall at convenient points along its solid or pier portions; but not under voids or in the bay portions of fenestrations. When there is a ground floor near the level of the ground, it is generally best to cut the needle holes through the wall in its pier portions only, and underneath the ground floor. The screw jacks are set under the ends of the needles on the inside and on the outside of the walls, and when the building is thus raised up bodily, it should be supported firmly by being made solid upon the underpinning or the built up substructure by means of close wedging with hard slate in Portland cement, so that it will maintain its raised position without subsequent subsidence. In the above it is implied that due consideration is given to the fact that the depth of the screw jacks below the ends of the needles must be obtained by excavations, etc., if this clear space does not already exist.

PERIODICAL OBSERVATIONS TO DETECT SUBSIDENCES.

All important new or raised structures should be carefully examined from time to time to immediately detect any subsidences which may occur. The nature, directions and extents of such subsidences should be carefully obtained, the practical inferences considered and duly noted, and the necessary provision made for adopting all needful precautionary measures adapted to stop further movements. The needles, screws, etc., should not be withdrawn until all subsidences have permanently ceased. The withdrawals should, in all cases, be done gradually.

INTELLIGENCE IN OBSERVATIONS NECESSARY TO EFFICIENCY.

In order that all of the foregoing important procedure may be done intelligently, and the remedies prove efficient, the amount, directions, and nature of the various displacements should be particularly noticed. To acquire the intuitive power here implied necessarily involves an intelligent appreciation of a number of considerations which are seldom apparent at a glance, and must be the result of practical training in such investigations, with the aid of the theories of the composition and resolution of various predetermined active forces that are present. It must also be considered whether the displacements be in the nature of single lean over, or of various degrees of inclination at different heights, or at different points in the length of the wall, or whether it be an incurvation or a bulging of the section of the wall, and, if the latter, whether it is regular or irregular, or compounded of straight sections and curves, and where they lie horizontally, vertically, or obliquely. Also note the extent of the inequalities of displacements in the same direction when these are in the nature of unequal subsidences from the original plumb or level position. The lines and arrises of special features, such as pilasters, piers, columns, jambs, lintels, sill and string courses, plinths, and other horizontal and vertical features of a building, afford good opportunities of detecting the presence of contorting forces. Any abnormal irregularity in the curved features, or in the curved portions of features, should also be noted. All of the foregoing is assumed as essential for a single inspection; but where the occasion admits of, or necessitates, testing the progress of abnormal movements, there should also be applied suitable gauges for registering the extents or inequalities of subsidences or other movements which take place in fixed intervals of times of systematically arranged observation. Thus, for showing any alterations in the width of a fissure or crack, or a lateral movement of one side over the other, paper pasted at several points is the best and simplest. When applied to external fissures the paper, and the cement with which it is fastened, should be such as not to be affected by damp. The effect of damp, and stretching or elasticity, on all papers, even when used for internal fissures, should be duly regarded, as otherwise the information afforded by the tests may be misleading. A lateral movement of one side of a fissure will produce a wrinkling of the paper. The direction of the wrinkle will not indicate which of the sides has moved; that must be determined from a consideration of other indications present which clearly point out the direction, or, as it is called in the language of graphics, the "sense" of the direction of movement.

Rod struts or laths, which bend under a slight pressure of abnormal thrusts, have been used to test the precise direction and extent of movements of central towers at the intersection of nave and transepts. These must be placed in the direction of suspected or apparent movement, and carefully observed from time to time.

It is also important to observe in all tests or series of tests whether the rate of movement is unvarying in equal times, or whether there is an acceleration or a retardation in the rate of displacement. When it is one of acceleration, it requires the prompt application of very effective measures for arresting the progressive movement. It is also important to note all evidences of changes in the direction of the action with which the abnormal forces operate, and whether any new forces or resultants have been created by the incidental changes of conditions which may attend building operations

DIRECTION IN WHICH FORCES OPERATE INFERRED FROM DIRECTIONS OF RUPTURING.

By a careful consideration of the elementary ideas of the nature of the forces of displacement, these principles can be applied to the interpretation of the fissures, cracks, ruptures, bulges, etc., which are the evidences of the action of disturbing forces, in direction and in extent, which affect any particular wall or building that we are about to investigate. Starting from the primary idea that all movements, however complex, are compounded of horizontal and vertical motion or active forces in various constant or changing ratios of combination, producing various oblique directions, we can thence form an estimate of these relative balances, or unbalanced portions, of disturbing forces, and the resistances of the tenacity of the materials, and of the construction of the building, by means of the displacements which they produce measured in these directions, then complete the graphic parallelogram of forces, and draw the diagonal as their resultant. If such measurements were constant, either in a single or compound direction, at different points of the fissure, the movements would either be horizontal, vertical, or diagonal to these two as the adjacent sides of a parallelogram. But if the measurements varied at different points of the fissure with a constantly increasing divergence—as, for instance, it showed an increase upward—it would be interpreted as a tilting action round a low fulcrum.

*By Alex. Black, C.E., architect, in the *Builders' Magazine*, F. V. Strauss, publisher, New York.

Ammonite, a New Explosive.

The qualifications it claims to possess are complete safety in conjunction with an explosive force slightly exceeding that of dynamite of the first quality.

Ammonite is described as consisting of pure ammonium nitrate and nitro-naphthaline, the two ingredients being thoroughly dried, ground, and afterward incorporated in heated edge runner mills. It is then sifted and fitted into metallic cartridge cases of various sizes, which effectually protect it from the absorption of moisture. These cases are completely water tight, and may consequently be immersed in water for an indefinite time. The successful use of ammonite depends on the employment of this water tight case, which, it appears, is the invention of the late M. Favier. Whether in large or small quantities, the charges of ammonite are invariably made up in these cases. If tons were supplied, the whole would be contained in such cases. There is some variation in size. The favorite and usual size, however, is a case 8½ inches long, containing 4 ounces of ammonite, the empty case weighing 1¼ ounces. The case is of soft white metal, very closely resembling, on a large scale, the tubes in which artists use oil colors, the main difference being that the small neck which carries the screw cap in the artist's oilcolor tube is here closed up without opening, being cut open when required for use, while the large base, instead of being closed in a folded edge like the oil tube, preserves its cylindrical form, and is closed with a screw cover, waxed and made water tight. As to character and softness of metal, the oil paint tube and ammonite case closely resemble each other. The principle on which safety is secured by ammonite is that it can only be fired by a detonator of mercury. The material may be burned freely in a furnace, when it melts and smokes and gradually consumes, and it may be struck to any extent without ignition of any kind, whether iron or any other substance be used. When fired by its own detonator, explosion is communicated from case to case, even when an interval of perhaps nearly an inch is left between them, the fact appearing to be that ammonite, like wet gun-cotton, requires a certain sort of wave impulse to bring about its explosion, but when that wave is imparted, it explodes readily.

Phosphograms.

The invention of M. Lipmann for producing colored photographs has received wide publicity, and excited a great deal of interesting discussion. Numerous photographers and physicists have followed M. Lipmann's example in applying themselves to the solution of the problem, and many curious facts bearing on the subject are being made known in the scientific periodicals. One of the latest contributions is by Mr. W. Ainsley Hollis, who has discovered that if a plate of glass or other suitable substance be coated with phosphorescent calcium sulphide and exposed in a photographic camera, so that the image of a well illuminated landscape or other brightly colored object may be focused on it, after a time a kind of phosphorescent negative is produced. This "phosphogram," as Mr. Hollis calls it, may be photographed by applying it to a sensitized film, and the negative when developed shows distinct signs of color. Whether this idea will bear working up for practical purposes remains to be seen, but the experiment is at any rate an interesting one, and might be made the subject of further investigation.—*Freeman's Journal.*

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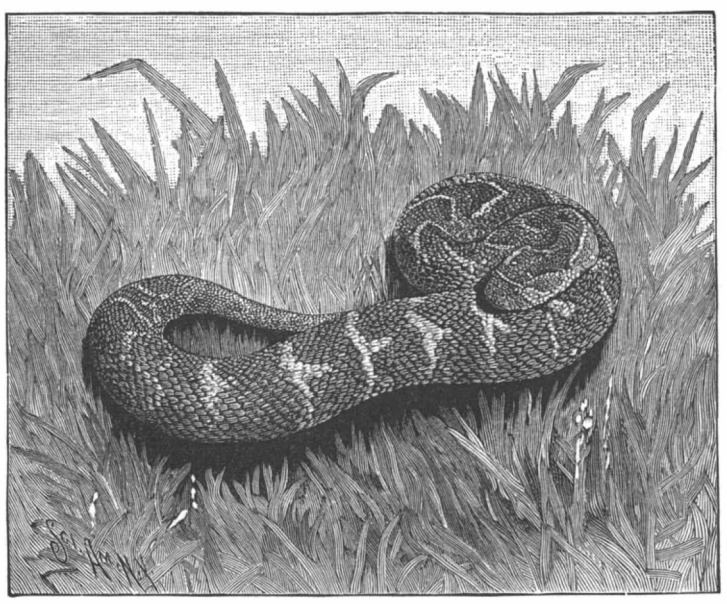
COLOR OF SNAKES AS AFFECTED BY CLIMATIC INFLUENCES.

BY G. R. O'REILLY.

The ophiologist well knows that the coloring of snakes is not a sure guide to specific difference of variety.

This is well understood, but perhaps it is not so well known that the pattern or distribution of coloring is constant in the same species. Now this is well shown in the specimens of *Bothrops atrox* and *Bothrops lanceolatus* figured in a recent issue of the SCIENTIFIC AMERICAN, and of the two specimens of *Xiphosoma hortulana*, illustrated on this page. There the *labarri* or *Bothrops atrox* from the dark woods of South America is seen to have the same pattern, but a much deeper coloring than his brother, the *Fer de lance* from the sunny canefields of Martinique and St. Lucia. The former harmonizes in shade with the black rotting leaves of the frequently inundated river bank in the dark forest, while the latter in color reminds us of the yellow and reddish soils of the often plowed canefield. Of the two specimens of *Xiphosoma hortulana* herein shown, the darker one comes from the gloomy ravines of the forest-clad mountains in the island of Grenada, while the lighter one, a purely yellow snake, is an inhabitant of the open and comparatively sunshiny mangrove swamp of Caroni, in the island of Trinidad. If any one will examine the snakes of this species, he will be astonished to see how much they vary in shade, and still will notice that the pattern in all is traced in a formation of rings along the sides more or less regular.



THE PUFF ADDER.

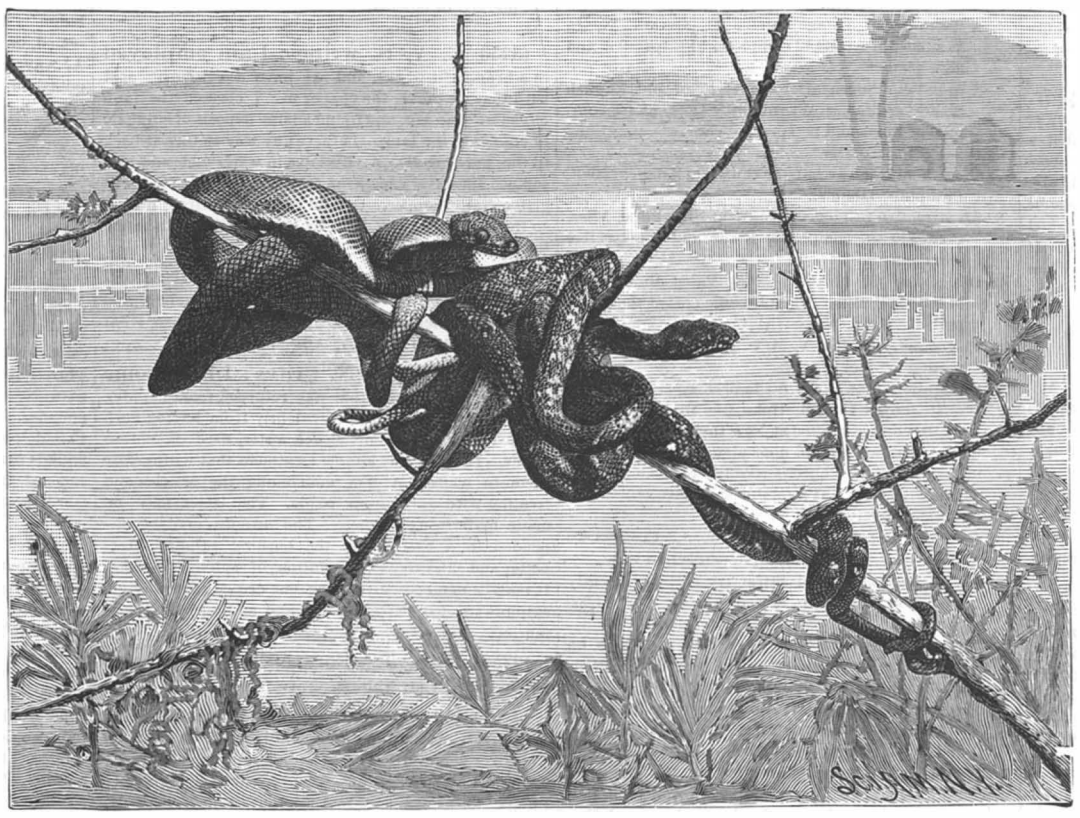
The diamond rattlesnake from the sunny plains of Guiria, in Eastern Venezuela, where the soil is of a reddish color, is reddish in his dorsal marks and much lighter than his fellow from the dark woods of swampy Demerara.

From this it would seem that the coloring is largely modified as regards shade by the nature of the light reflection in which the animal lives. In a certain sense the color of his surroundings is photographed on his skin. It is said that mountainous districts are favorable for poetic genius, and that few poets are natives of level, monotonous countries. If this is true as regards vividness in the human imagination, as certainly seems to be the case, it is none the less so with the coloring of snakes. Take the South African puff adder (*Clotho arietaus*) for instance. The puff adder, which is figured above, is a short, thick, broad-headed black and yellow deadly snake. Snakes of this species from the lower lands near the sea are dull in color. The yellow is pale and the black dirty looking, like an old dress coat coming to its last days on the back of a tramp. But the mountain puff adder is very different. He is arrayed in a gorgeous dress of golden yellow and the deepest black velvet. And it is only natural that while his home for ages has been in the land of sunny rocks and darksome shadows, he should bear photographed in his skin with nature's own photography the reflection of these objects.

The lora of Venezuela (*Ahaetulla liocerca*) shows the same difference. On the mountains he is arrayed in green of the most vivid brightness, along each side is a band of gold, and the scales of his under parts are of a mother-of-pearl white, while his brother of the plains appears dirty all over. In July, last year, the writer caught a young boa constrictor on the lowlands of Quebranta, near Guiria, in Eastern Venezuela. He was covered with markings of light gray and dark gray. In September, I got one of the same size from the hills of Arouca, in Trinidad, and he was, of course, the same in pattern, but black and white. Boa constrictors from the dark forests of the plains of Chaguanas, in the same island, are not nearly so clearly marked as those from the hills of Zoco, twenty miles to the northeast. And some time ago I had one from the hills of Brazil much more brightly marked than any I have yet seen.

There are now in my collection in the Central Park several fine specimens of *Xiphosoma hortulana*, which well illustrate this variation of shade. One is yellow, so pale that the pattern is not perceptible. A second is red, with yellowish ring-like markings. A third is a reddish brown, with the same marks. A fourth is jet black, with white rings, and a fifth has, strange to say, a white groundwork, with jet black circular spots.

This same superiority of the colors of mountain snakes may be noticed in many countries. Perhaps not of snakes alone is it true, but of other animals also, that after a long sojourn in their home they bear photographed on their skins the reflection of their surroundings.



TREE SNAKES (XIPHOSOMA HORTULANA).

Our Wood Pulp Industry.

The vastness of our wood pulp industry, which is but comparatively a few years old, is probably not realized by people not directly interested in it. At first, wood pulp was used entirely in the manufacture of newspapers, but now it is employed for manifold purposes. Its use bids fair to be large for mouldings, and it is being made into barrels, tubs, pails, washboards, water pipes, doors, caskets, carriage bodies, floor coverings and furniture, imitations of leather cloth and silk have been made from it. Successful experiments have been made wherein it has been used in the manufacture of armor plates.

Thus we see the usses to which wood pulp can be put are almost unlimited. The great consumers of wood pulp at present are the paper manufacturers, who consume about ninety per cent of the total production. Most paper made to-day, from the woody newspaper up to the fine grades of writing paper, contain more or less of this ingredient. The industry naturally is enormous. At present there are fully 238 mills in the country and quite a number building. The total capacity of these mills is about four million pounds per day, at which rate they consume one million cords of wood a year.

These figures show an increase in the business of about five hundred per cent in the past eight years, and the same time in the future bids fair to see even greater strides than this. It is but four years since sulphite wood pulp has been made, yet now there are twenty-nine mills manufacturing it and twelve in course of erection.

Yet this grand and growing industry is causing considerable apprehension among those interested in our forests. They think that wood pulp is capable of being put to so many uses that the time will come when the cutting of trees for its manufacture will be of such magnitude as to deplete our forests. At the present stage of the industry this is hardly to be feared, as many mills use the large trees in their vicinity, giving the smaller ones an opportunity to grow. Even where trees are cut down indiscriminately, there is not as much harm done as in some places where the trees are cut down for lumber. Still, this indiscriminate cutting by wood pulp mills will have similar results to lumbering operations, and the two in time will, if continued, strip the country of one of its greatest resources, its immense forestry. As trees from thirty to thirty-five years old are the most suitable for wood pulp, it will take one generation, with proper culture, to grow a new supply for the industry.—*Com. Bulletin.*

Reclamation of the Sahara.

The most remarkable example of reclamation by means of artesian well water is found in the desert provinces or departments of Algeria under the French rule. The area, officially given, of French Algeria is 184,465 square miles. The outlying portion is put at 135,000 square miles. In this total of over 329,415 square miles one-half belongs to the Sahara or desert. The European population in 1887 was about 250,000; the natives and naturalized were 3,328,549, making a total of 3,578,549. Cultivation by the means of flowing well waters has been sedulously fostered by the French colonial government for both political and economic reasons. Such wells as a means of reclamation began systematically to be bored in 1857, the French engineer, M. Jus, having demonstrated in 1856 that the desert was endowed with large supplies of under-ground water. The total number of wells that have been bored since that date in the departments of Algiers, Oran and Constantine is stated at 13,135. These wells range from 75 to 400 feet in depth, and the low pressure common to the majority of them forces the water over the small bored casings to a distance of about two feet above the ground. The waters are then collected in small ditches, which convey them to the vineyards, date trees and fields of durra, millet, wheat, etc., which comprise the chief products. In all, about 12,000,000 acres have been reclaimed in this way. The government bores are at least 1-10 of the whole number. As an illustration of the reclamation brought about by this well irrigation, the following figures from a report made in 1885 will be of value, but they relate solely to the cultivation of the grape for wine-making purposes. In the province of Algeria there are 60,322 acres; in Constantine, 25,021 acres; in Oran, 26,114. Under this species of cultivation Algeria is becoming a great wine-growing country. It sent to France during eleven months of 1886, 10,513,966 gallons of wine; and of cider in the same year, 219,277,124 gallons were made. The date palm is the largest product of the desert oases proper. The total area under colonization or settled occupation in 1887 is given at 49,400,000 acres; under cultivation by irrigation in wheat, barley, oats, vines, olives, dates, tobacco, etc., at 17,041,133. The forest plantations cover 5,000,000 acres.—*R. J. Hinton.*

Heavy Woods.

There are 413 species of trees found within the limits of the United States and Territories, sixteen of which, when perfectly seasoned, will sink in water. The heaviest of these is the black ironwood (*Condalia ferrea*), found only in Southern Florida, which is more than 30 per cent heavier than water. Of the other fifteen, the best known are the lignum vitæ (*Guaiacum sanctum*) and the mangrove (*Rhizophora mangle*). Texas and New Mexico lands, full of queer, creeping, crawling, walking, and inanimate things, are the homes of a species of oak (*Quercus grisea*) which is about one and one-fourth times heavier than water, and which, when green, will sink almost as quickly as a bar of iron. It grows only in mountain regions, and has been found westward as far as the Colorado desert, where it grows at an elevation of 10,000 feet.

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RECENTLY PATENTED INVENTIONS.

Mechanical Appliances.

KNITTING MACHINE. — Julius Freiloehr, New York City, and Louis Tisch, Hoboken, N. J. This invention relates to machines for forming knitted fancy trimmings, providing for such work a machine of simple construction which requires no Jacquard mechanism to control the pattern of the fabric. The invention consists of a series of pins acting on the thread guide bars to reciprocate them. The devices for shifting the sliding thread guide bars are located at the ends of the latter, each device being provided with sets of movable pins, and means are provided for simultaneously imparting a sliding motion to the corresponding sets of pins of the devices.

STONE CUTTING MACHINE. — David Rettiger, Strong City, Kansas. This invention covers an improvement in machines with revolving cylinders having steel cutters in combination with a moving carriage, to efficiently reduce stone from a rough to a finished planed or moulded surface. The chisels are adjustable, and so arranged as to be readily reset when worn, while in one operation the surface of a rapidly moving stone may be first scabbled off, making spawls large enough to be merchantable, and then planed, smoothed or moulded. An automatic adjustment of the speed of the stone is provided for, which will cause a temporary slowing with extraordinary resistance, while a steady, uniform method of feeding is effected. The machine is strongly yet compactly built.

PRINTING PRESS. — Hynek Breuer, New Prague, Minn. The bed of this press has two separate and independent vertically adjustable rails, set screws at the side of the bed supporting the rails, upon which an impression roll travels, the latter having a body section equal to the width of the bed and end disk sections of a hard elastic substance adapted to engage with the rails, hand wheels being connected with the ends of the rolls. The impression is readily regulated by means of the set screws under the rails, while the press is of simple and strong construction and can be made at a low cost.

PRINTING PRESS ATTACHMENT. — Howard F. Bowers, South Framingham, Mass. This is a jogging device for evening the sheets delivered from the fly of a press. Combined with the table and fly is a jogging board hinged to the table opposite the free end of the fly, the board having depending fingers extending through holes in the table, while one end of a rod is hooked to the fly crank and its opposite end extends loosely through the jogging board, there being an adjustable stop on the rod to engage the board. The device is especially adapted for miscellaneous or job work, and may be quickly and accurately adjusted to suit sheets of different sizes.

Miscellaneous.

TWINE CUTTER.—Walter L. Gibson, Turnbull, Fla. This invention relates to finger rings with knife attachments for use by salesmen in cutting twine, starting to rip cloth, cutting button holes, etc. A miniature knife case is arranged to project at right angles in front of the ring, and the blade is pivoted at the rear end of the case, being held closed by a spring except when it is raised and held open by the pressure of the thumb on a crank-like extension of a pin fast to the blade. When the knife is closed the blade shuts down within the recessed case after the manner of an ordinary pocket knife.

VEGETABLE MASHER.—Kate F. Taylor, Smethport, Pa. In a cylindrical body having a sieve at the bottom and a cross bar at the top is journaled a handled rod carrying on its lower end a blade to press upon the sieve, and rods at right angles to the blade, also adapted to press on the sieve. The potatoes or other vegetables placed in the body are finely mashed and forced through the sieve by rotating the rod. If desired the vegetables are placed in the masher when raw, the masher being then placed in the kettle of boiling water until the vegetables are sufficiently boiled, the draining and mashing being quickly effected on removal.

TEMPERATURE REGULATOR. — Adam Kelly, Smithfield, R. I. This is an apparatus applicable to rooms heated by steam, hot water or hot air, passed through pipes, the supply being controlled by a valve. A pivotally mounted thermometer tube is employed, with a ratchet wheel controlling the valve-operating lever, the connections being such that when the temperature rises above or falls below a fixed point the ratchet wheel will be moved in a proper direction to close or open the valve.

LOCK MECHANISM FOR REVOLVERS.—Adamantius C. Houston, Pickaway, West Va. In this fire arm a spring-pressed lever is pivotally connected with the firing pin, while the trigger is mounted to turn and has a series of arms adapted to alternately engage the lever, which is returned to its normal position, by a spring connected with the firing pin. By this improvement the cylinder is rotated and the firing pin is moved by revolving the trigger.

BOTTLE FILLING MACHINE. — Nelson Smith and Alvin B. Marcy, Wallkill, N. Y. This invention relates especially to devices for filling receptacles with milk, the body of the device consisting of a tank car with open top, a series of piped apertures leading from a metal bar transversely embedded in the floor of the tank near end. The construction is such that the receptacles will be partially filled from one end of the car and wantage from previous presence of foam will be supplied from the opposite end, while the flow of milk from the car will be as regular when it is nearly empty as when it is nearly full. The valves at each end of the car are held closed by gravity, and means are provided whereby both sets of valves may be worked concertedly or independently. All portions of the device brought in contact with the liquid may be conveniently and expeditiously cleaned.

STOVE. — George E. Leonard, Menominee, Mich., and Silas A. Stowe, Neenah, Wis. This is a drum tubular sectional stove, with an enlarged upper part which communicates through a series of pipes with a smoke chamber below the ash pit. These pipes surround and incase the firepot, thus increasing the radiating surface, also improving the air circulation at the surface of the fire pot. The drum, above the main portion of the stove, consists of a central pipe with hollow heads at both ends, the heads being connected by a series of pipes surrounding the central pipe. The invention provides a stove having a very large radiating surface, and the arrangement of the dampers is such that the amount of such surface may be greatly varied.

MAKING CHROME YELLOW.—Frederick W. Ihne, Kansas City, Mo. This invention is for a process for making from galena chemically pure chrome yellow having great covering power. The process consists in first dissolving pulverized galena with nitric acid to produce liquid nitrate of lead and then precipitating chromate of lead by subjecting the nitrate of lead to the action of the bichromate of potassa, neutral chromate of potassa, or chromate of potassa soda, in proportions and after a manner described. The process is very simple, and the crude lead ore is transformed into chrome yellow in from three to four days.

SCOOP. — Levi L. Hall, Parkersburg, West Va. This is a device having an adjustable or extensible digger section, adapting it for breaking up hard lumpy sugar, soda, dried fruits, etc., so they can be readily dipped up by the scoop, avoiding the necessity of using a separate device for breaking up the article. The digger section is held to slide on the body of the scoop, and has teeth at its free end, the connection of the sections being such that the digger section may be held in either its extended or retracted position.

CUSPIDOR ATTACHMENT. — Stephen Horseman, Estacado, Texas. This invention relates to a swing device, consisting of two brackets, a washer and a pivot pin, adapted for attachment to a cuspidor, whereby the latter may be pivotally connected with a seat or other support, and held in a horizontal position, while it may be swung out from or beneath the seat, and readily removed when necessary.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN BUILDING EDITION.

AUGUST NUMBER.—(No. 70.)

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1. Handsome plate in colors of a row of wooden houses designed by Munn & Co., architects, and erected for Mr. J. H. Shafer at Newark, N. J. Perspective and floor plans. Cost of four houses from $16,000 to $18,000.
2. Colored plate of the beautiful and substantial stone residence of S. Clark, Esq., on Riverside Park, New York. Mr. Henry Kilburn, architect. Two perspective elevations and floor plans.
3. A cottage recently erected at Upsal Station, Pa., at cost of $6,500 complete. Floor plans and perspective elevation.
4. A picturesque cottage erected at Newark, N. J., at a cost of $4,963.72 complete. Perspective and floor plans.
5. A round end house after the style of old English homes, erected at Wayne, Pa. Cost $5,463 complete. Plans and perspective view.
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7. View of an iron earthquake church at San Sebastian, Philippine Islands.
8. An attractive residence erected at Brookline, Mass. Cost $10,518 complete. Plans and perspective elevation.
9. Design for the thirteen story Pabst Building at Milwaukee, Wis. The probable cost of the building is $500,000.
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11. Illustration of an easily made piazza.
12. The St. Jerome Chapel, Hotel Des Invalides, Paris.
13. A $1,500 cottage erected at New Dorp, Staten Island. Perspective view and floor plans.
14. St. John's M. E. Church, recently erected at New Rochelle, N. Y., at a total cost of $63,580. Plans and perspective.
15. A cottage erected at Roseville, N. J. Cost $2,800 complete. Floor plans and perspective view.
16. A very convenient and attractive cottage recently erected at New Dorp, Staten Island. Cost $4,950 complete. Perspective and floor plans.
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18. Miscellaneous contents: A millionaire's residence. —An improved hot air furnace, illustrated.—Iron and steel roofing.—Improved woodworking machinery, illustrated.—Architect of the Woman's Building at the Columbian Exhibition, Chicago. —The plain design is the best.—Inside sliding blinds.—An improved tenoning machine, illustrated. — The Cudell trap. — Lightning rods.— Properly anchoring beams in walls.—A proposed nniversal building law. — Windmills to supply water for houses, etc.—Graphite grease.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(3253) C. V. S. writes: I am employed in a head-light works, and we have a sulphuric acid bath that we pickle the copper in. I cleaned the tank out some time ago, and found a large deposit of sulphate of copper in the tank. Is there any way to turn it back to the pure metal? A. Dissolve in water and add iron scrap. Dissolve excess of iron with acid. This will give metallic copper. Or add the iron in larger pieces, so that it can be picked out by hand, after precipitating the copper.

(3254) T. L. R. asks: 1. Is all pure gold the same color? A. Yes; if of the same surface and polish, and thick enough to be opaque. 2. Also, what is meant by 1,000 fine? A. Absolutely pure.

(3255) T. W. McN. writes: I have some white wool underwear that was returned from laundry spotted brown and yellow, evidently from having been washed in chloride lime bleach water, used on cotton goods. Is there any simple treatment that will restore them to white? A. Try moistening the articles and treating with sulphurous oxide. The latter may be made by burning sulphur. The articles may be suspended in a barrel over the burning sulphur. It is better and safer to use a solution of sulphurous acid. It may be made by dissolving one or two parts sodium sulphite in 100 parts of water and adding 1 or 2 parts muriatic acid.

(3256) R. S. J.—For replies relating to patents, send your address.

(3257) P. S. asks: 1. How many volts and amperes are required to operate one gallon of nickel and silver solution? A. The number of amperes used for nickel plating depends upon the surface. Probably 1 ampere to each square foot is about right. The E. M. F. should be about 7 volts. 2. What good work would you recommend on constructing dynamo-electric machines, also on lacquers? A. We think "Experimental Science" would meet your wants.

(3258) P. J. S. writes: 1. I am building an armature with washers. I have some No. 20 iron; will that work, or must it be thinner? A. No. 20 will answer. 2. What size wire will be required in accordance with the iron I mentioned? If thinner washers will be required, give size of wire. A. There is no special relation between the thickness of the washers and the size of the wire. 3. What size wire would be required in fields? I wish to build a motor and use as little battery as possibly will run it. A. Without knowing the size of the motor, we cannot give information of any value on this point. For electrical calculations in general we refer you to "The Arithmetic of Electricity," $1 by mail.

(3259) H. M. asks: What is isinglass? Is it soluble? A. The word is applied to two entirely dissimilar substances. One is mica, a natural mineral, used for lights in stove doors and in electrical apparatus. The other is a fine form of animal or fish gelatine. The latter is soluble in water. Mica is insoluble.

(3260) B. F. B. asks: In receipts which read, "Take 2 parts of this, and 7 parts of that, and 3 parts of something else," etc., what is one part equal to? Is "a part" to be by weight or measure? In the above, am I to believe the whole is 12 parts or 12 lb., and that the 3 parts equal 3 lb.? etc. A. Parts by weight are always to be understood except where otherwise stated. The total number of parts stated give the basis for the proportion of one part to the whole.

(3261) E. H. asks for a recipe for making adhesive fly paper. A. (1) Resin 9 parts and linseed oil 4 parts, or (2) resin 8 parts, linseed oil and turpentine 4 parts each, honey ½ part, or (3) resin 4 parts, molasses and linseed oil 1 part each, boiled together.

(3262) E. M., Jr., writes: I want to make a simple electric motor after the pattern described in SCIENTIFIC AMERICAN SUPPLEMENT of April 14, 1888, No. 641, on pages 10240 and 10241, but not so large, only large enough to have the power to run one ordinary sewing machine. What size shall I make it, and what size wire shall I use on the field magnets and armature, also how much wire will it take for each, provided a chromic acid battery is used to run it, the armature and field magnet being connected in series? A. Make it about two-thirds the size of the motor referred to, and wind both armature and field magnet with No. 20 wire. It will require about 2½ pounds of wire. 2. How many 5×7 chromic acid cells, would it take to run it normally? A. Four. 3. Does a chromic acid battery give off unhealthy fumes? A. Not as long as the zincs are well amalgamated. 4. How near together should the tin foil sectors of a 20 inch plate Wimshurst machine be to each other, if there are sixteen of them? A. About twice their own width. 5. What chemical is used to stain glass? A. Different substances are used for producing different colors. Consult works on glass manufacture. 6. Can an induction coil charge a Leyden jar? A. Yes.

(3263) A. G. asks for a receipt for making suitable size for applying gold leaf to silks or satins. A. A good size for attaching gold leaf to silk and satin is made by beating the whites of eggs thoroughyl, allowing the resultant mass to subside, forming liquid albumen, reducing the albumen by the addition of an equal quantity of water. The size is applied and allowed to dry. The gold leaf is laid on and the type or dye is warmed and pressed upon the gold leaf. Wherever the albumen size is heated by the die, it is coagulated and rendered insoluble. The leaf remaining on other portions of the fabric may be brushed off or wiped off with a damp cloth.

(3264) P. A. M. asks: 1. Why is it undesirable to put two or more different kinds of open circuit batteries in one circuit? A. This idea we presume arises from the supposition that any one using batteries will select one kind best adapted to his wants. We see no objection necessarily attendant on mixing different kinds of batteries. 2. What is the objection to using larger diaphragms than are commonly used in telephone receivers and transmitters? Would they not be more sensitive? A. The best articulation is secured by the use of small diaphragms. With large diaphragms articulation is defective. 3. What carbon batteries may be sealed, or which do not require a vent for escaping gas? A. Any battery using chromic acid or bichromate of potash or bichromate of soda may be practically sealed. Gas will be liberated only when the zincs are poorly amalgamated; a small vent should be provided for this contingency. 4. Which form of battery is considered the cheapest for operating small motors or incandescent lamps? A. Either the plunging or Bunsen. 5. Which is the cheapest process for making zinc plates for printing, in which the lines will all be in relief—the reverse of intaglio? A. Consult SUPPLEMENT, No. 656.

(3265) T. C. W. asks: 1. What water pressure is supplied to the residences of Cleveland and some other large cities of the United States? A. You can probably obtain the water pressure of your city by addressing the superintendent. We have no data other than New York 10 to 40 pounds, Brooklyn 20 to 60 pounds, according to flow and elevation of ground, Philadelphia 5 to 25 pounds. A few towns 50 to 80 pounds per square inch. 2. What is the horse power of some of the various types of locomotives in use? A. Our largest locomotives will develop as high as 800 horse power. 3. How can the horse power of locomotives be calculated? A. The horse power of locomotives may be computed the same as any duplex steam engine from boiler pressure, cut-off, area of pistons, and piston speed. 4. Please explain why arc lamps cannot be burned in parallel, also why incandescent lamps cannot be burned in series to advantage. A. Arc lamps vary perpetually in resistance and require the current to be as nearly as possible constant. If arranged in parallel, some would take more than others, and the resulting light would be even more unsteady than it is now. Incandescent lamps can be burned either in series or in parallel. The latter method gives a lower initial difference of potential, and makes it possible to shut off one lamp at a time without special apparatus to pass the current around it.

(3266) C. L. C. asks: 1. What is a good treatment for chronic rheumatism? A. We refer you to SUPPLEMENT, No. 299, page 4772. 2. Can it be cured by electricity? A. A judicious application of electricity often proves beneficial. 3. If so, what kind of a simple and inexpensive instrument can be constructed for that purpose? A. You can procure a medical battery from any of the dealers in electrical supplies.

(3267) A. P. E. wants to reproduce a medal in silver galvanoplastically. Is the cyanide solution of the nitrate of silver as good as of the cyanide or chloride of silver? What solution of silver is best for above purpose? Are 2 gravity cells or 4 Leclanche cells sufficient to reproduce a dense and thick deposit of silver, analogous to an electrotype deposit of copper? A. The usual method of copying medals is to take an impression in wax or gutta percha, coat the model with fine plumbago and take a copper shell by the galvano-

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plastic method, finally electroplating the copper copy, using a cyanide solution of silver.

(3268) H. C. J. asks (1) if there is any chemical that paper can be saturated with—and not be discolored—so that an electric current will burn it black as soon as it touches it. A. We know of no chemical that could be used on paper in the manner suggested without producing some discoloration. Iodide of starch is probably the nearest approach to it. 2. Please tell me if there is any kind of ink which will fade in a short while, and also an ink which will appear on paper after being exposed to the light. A. Weak purple aniline ink will fade in a short time if exposed to light. An ink formed of a weak solution of nitrate of silver will turn brown on exposure to light.

(3269) C. S. W. S. writes: The speed of electricity was a subject for discussion lately, but the exact rate could not be arrived at. According to a recent article it should require only one-half second to transmit a signal through the Atlantic cable, even less for 3,000 miles. Can any rate be given? A. No exact rate can be given. The electrostatic conditions regulate the practical velocity of transmission of an electric signal. Electric impulses theoretically may travel with the velocity of light. The article referred to relates to the following. Experiments now in progress at McGill College, Montreal, under the auspices of the British and Canadian governments, to ascertain the longitude of Montreal by direct observations from Greenwich, have led to the accomplishment of a remarkable telegraphic feat. The first thing to determine was the length of time it took a telegraphic signal to cross the Atlantic. An automatic contrivance, whereby the land line could work into the cable, was provided, and a duplex circuit was arranged, so that the signal sent from Montreal would go over the land lines to Canso (Nova Scotia), thence over the cable to Waterville (Ireland), and return to Montreal again. Attached to the sending and receiving apparatus was a chronograph, which measured the time. Out of a couple of hundred signals sent, it was found that the average time taken to cross the Atlantic and back again, a distance of 8,000 miles, occupied a trifle over one second, the exact time being one second and five one-hundredths.

(3270) S. W. R. asks: 1. Please give me formula for making carbon plates for batteries. A. You will find a simple process of making carbons on page 307, vol. 60, SCIENTIFIC AMERICAN, also in "Experimental Science." 2. Is there a cement by which carbon plates can be joined together and retain the connection? A. Carbon plates may be cemented together by using a mixture of very finely pulverized carbon and flour paste, afterward carbonizing in the usual way. The joint may be strengthened by saturating it with sugar sirup and recarbonizing. 3. Where can I procure carbon plates? A. From manufacturers and dealers who advertise in our columns.

(3271) J. F. B. writes: 1. Please describe a cheap dry battery with an E. M. F. of about 1·50 volts that would do for closed circuit work. Would a dry battery made as follows do for a 6 candle power incandescent electric light?—for the positive, a copper plate 2×3 inches; upon that are two blotters, between which is sprinkled powdered blue stone; on that is placed a 2×3 inch zinc plate. A teaspoonful of water is poured over the whole. If so, how many would it take? A. The battery you describe would soon become inactive. The Trouve battery is constructed something upon the same principle. It yields a small current, but will maintain it for a very long time. This battery is formed by separating a zinc and a copper plate by many thicknesses of blotting paper, enough to make the distance between the plates say 1½ or 2 inches. The blotting paper is divided into two equal portions; one part is saturated with a saturated solution of sulphate of copper, the other portion is saturated with a solution of sulphate of zinc. The part saturated with sulphate of copper is placed in contact with the copper plate, and that saturated with the sulphate of zinc is placed in contact with the zinc plate. An element of this kind inclosed in an air tight jar remains in working order for several years. Gassner's dry battery is described on page 306, vol. 61, SCIENTIFIC AMERICAN. It has an E. M. F. of about 1·5 volts. 2. What is the E. M. F. of a bichromate battery 2 inches in diameter and 2 inches deep with 2 carbon rods ½ inch in diameter and 1 zinc rod ⅜ inch in diameter? A. The E. M. F. of all bichromate batteries is about 2 volts, without regard to the size of the carbon or zinc plates.

(3272) G. V. writes: I have made a motor like the one described in 641, and in "Experimental Science," and I have used 18 bell wire, but the motor would not go. Could you tell me in SCIENTIFIC AMERICAN the reason why, and if bell wire is the cause? I have put 8 pint glass jar bichromate cells on it, and would you please tell me how many cells of that kind I would need? A. The insulation on the bell wire is too thick to permit of winding on the required length. Use double cotton-covered magnet wire. Your battery cells are rather small. Connect them 4 in parallel, and use 8 such groups in series, or use 8 large cells with plates 6×8 or 8×10 inches.

(3273) W. R. asks: What makes the two halves of a Gramme ring armature in multiple arc when the wire is in series? Is it caused by the brushes or by the induction of the field magnets? How could it be arranged in series? A. The current flows from the neutral point in each half toward the brushes. In a motor the current entering the ring from the brushes flows in opposite directions. There is no way of arranging the two halves in series.

(3274) G. H. G. asks: 1. What is the best method of making oxygen gas? A. Probably for small amounts from the ignition of a mixture of chlorate of potassium and binoxide of manganese. Many other methods have been proposed and tried. On the large scale Brin's process, described in our SUPPLEMENT No. 623, seems to have met with success in England.

(3275) C. T. asks: Can real ebony be glued to mahogany or other hard woods with a certainty of preserving a fast joint? A. Use the finest white glue or gelatine dissolved in acetic acid or strong vinegar. The surfaces of the wood must be roughened.

(3276) B. S. W. asks whether the accompanying specimen of lime rock is of a water or volcanic formation. A. The sample sent is carbonate of calcium or calcite, and is unquestionably a deposit from watery solution. Volcanic or thermal action may have had an agency in effecting its deposition.

(3277) A. W. asks (1) how the dry developer put up in powder form is made. A. Use any formula for a developer. Powder the substances and place them in paper cartridges in the proper proportions; separate the different ingredients by wads of cotton. 2. Is common powder used in the manufacture of the so-called cannon fire crackers? A. Meal powder is used in fire crackers.

(3278) C. H. G. asks: What is the speed of light? Also what is the speed of electricity? A. The speed of light and electric waves are about the same, that is, 186,000 miles per second. The speed of electric signaling through a wire depends on many factors and varies greatly for different lines.

(3279) W. W. says: I have four conical wall tents which are good except for small spark holes. Can you tell me of a cement or glue that will stick on small patches of canvas, and will resist the rain? A. You can cover the holes with patches of canvas cemented by means of leaf gutta percha such as the tailors use. A hot pressing iron is employed to melt the gutta percha.

(3280) N. N.—For table of freezing mixtures see SUPPLEMENT, No. 551, page 8800.

(3281) J. R. G. says: Please give directions for making cement walks, also asphalt walks. Will the cement for sidewalks be suitable for cellars? A. For cement walks use one part best Rosendale cement and two parts clean sharp sand. Make a stiff mortar, mix thoroughly, spread three inches thick. Excellent for cellars. Ashpalt requires heat.

(3282) H. H. H. asks: How many degrees Fah. melt platinum? A. 3080° Fah. It can be melted by the oxyhydrogen blowpipe on charcoal or in a lime crucible.

(3283) L. B. M. asks: 1. How much ascensional power does one cubic yard of hydrogen gas have? A. Pure hydrogen can lift 500 grains per cubic foot or one and nine-tenths lb. per cubic yard. 2. Does the form of the receptacle affect the lifting power? A. No.

(3284) E. M. H. asks: 1. In using the oxyhydrogen light for steropticon purposes, the gases being compressed in cylinders at a pressure of 225 pounds to the square inch, is there any danger of an explosion occurring from the admixture of the two gases, or from other cause, in the use of light, and if so, how could such an explosion occur? A. If the gases are pure when compressed, and if the cylinders are strong enough to withstand the pressure, and if oxygen cylinder contain no hydrocarbon, and the hydrogen cylinder is free from oxygen or air, there will be no danger of an explosion so long as the pressure in both cylinders is greater than the pressure in the burner. If however one cylinder becomes nearly exhausted while the other has considerabe pressure, and if the burner from any cause becomes stopped, so that gas may escape from the cylinder having the greater pressure to one having the least, there will be danger of an explosion on relighting the burner. 2. Is there any book published on the magic lantern that is reliable, that will be of assistance to any one in using the magic lantern, and if so, what is the name of it, and where can I purchase same? My reason for asking the question in regard to the oxyhydrogen light is that I would like to be satisfied one way or another in regard to it, and appeal to you as the best authority. A. "Experimental Science," price $4 by mail, contains a long chapter on "Optical Projection," which is very complete. We can also recommend Wright's "Optical Projection," price $2 by mail, and Dolbear's "Art of Projecting," price $2.

(3285) C. C. asks: 1. Supposing a current from a battery would exert an attractive force of five pounds on a single electro-magnet, how much attractive force would be exerted on each of six electro-magnets whose coils are wound seriatim with the same wire, the wire to be continuous from first to second, and so on, and then returned to battery? A. It is a question of ampere turns. If you get the same number of ampere turns, and the conditions are otherwise the same, the results will be alike in both cases. 2. How does the current in an electric motor act on the field magnet and armature to produce the force that revolves the armature? Is it attraction or repulsion, or both acting alternately? A. In a drum or ring armature motor the poles are constantly being displaced in one direction, while the material of the armature is being drawn forward by the field magnet in the opposite direction. It is attraction mainly that is concerned in the rotation of the armature. 3. What cheap book explains all these matters and gives an insight into the elementary and practical principles of electricity and magnetic forces? A. We know of no very cheap book that would be of use to you; we can, however, recommend "Experimental Science," price by mail, $4.

(3286) P. D. asks: 1. Has the phonograph been developed to a degree which warrants its extensive use in the displacement of stenographers? A. The phonograph can be used in lieu of a stenographer, and is so used by many. 2. Please give recipe for a good furniture polish. A. Try the following: 4 ounces of orange shellac dissolved in 2 pints of alcohol; add to this 2 pints of linseed oil and 1 pint of spirits of turpentine. Mix thoroughly and add 4 ounces of sulphuric ether and 4 ounces of ammonia water. Apply with a sponge or cloth.

(3287) W. C. R. asks: 1. In referring to George M. Hopkins' motor, No. 641, SCIENTIFIC AMERICAN SUPPLEMENT, what kind of wood is best suited for the armature and other parts? A. Hard, well seasoned maple is a good wood for this purpose. 2. What is that part on the armature that divides the hub from the collar? A. It is a space. 3. Concave face 2½ inches across, is that right, on top and bottom? A. Yes. 4. What kind of battery is best suite for the motor mentioned? If you have among your papers how to make such a battery, I would like to know the number, or more of same. A. Consult SUPPLEMENT, No. 792, also "Experimental Science."

(3288) W. W. T. asks how to prepare strawberry extract. A. Harrop's "Monograph on Flavoring Extracts," etc., $2 by mail, contains numerous formulæ of this character. A receipt for strawberry essence is the following: Glycerine 2 parts, nitric ether 1 part, ethyl acetate 5 parts, ethyl formate 1 part, ethyl butyrate 5 parts, methyl salicylate 1 part, amyl acetate 3 parts, amyl butyrate 2 parts. Other formulæ are given in the above work.

(3289) L. F. M. writes: 1. In winding the armature core for the motor in SUPPLEMENT, No. 641, what is done with the ends of the wire after it is wound? A. The ends of the wires are connected with the screws which take the place of commutator bars. You will find this feature described in the article referred to. 2. Can you give me a formula of substance or a liquid that when applied to the gum of the teeth it will cause the teeth to become loose? A. We know of no substance that would accomplish what you describe without, at the same time, doing great physical injury.

(3290) S. D. M. G. says: On page 49 of the issue of July 25 of the SCIENTIFIC AMERICAN, I noticed a platinotype printing process which is new to us and which I do not thoroughly understand. Will you please answer the following questions through your paper for the benefit of our camera club? 1. In what proportions should solutions A and B be used? A. Mix equal parts. 2. Will any paper, such as is used for blue prints, do, or does the process require a specially prepared paper? A. Use plain photographic paper, to be had of photo dealers. 3. Is any toning solution necessary? If so, what is the formula? A. No. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 711. 4. Is there any simple process by which blue prints may be turned brown or black? A. Make a solution of

Borax	2¼ oz.
Hot water	38 "

Add sulphuric acid in small quantities until blue litmus paper is turned slightly red. Then add a few drops of ammonia until red litmus paper turns blue. Then put into the solution 150 grains of red crude gum catechu, and allow it to dissolve, with occasional stirring. To tone a print, immerse it a minute or longer until the desired tone is obtained The solution will keep indefinitely. Gum catechu can be obtained from drug stores.

(3291) W. J. B. asks what kind of carbon to use for a bottle battery or cup for a dry battery, and give names of necessary address for a dry battery. A. Use plates prepared for the purpose and sold by dealers, or use carbon rods such as are employed in electric lighting. If the rods are coppered, the copper should be removed with nitric acid. You can use an ordinary porous cell. You will find Dr. Gassner's dry battery described on page 306, vol. 61, SCIENTIFIC AMERICAN, also in "Experimental Science."

(3292) J. H. H. asks: 1. What number of the SCIENTIFIC AMERICAN or SUPPLEMENT explains how to make an induction coil? A. See article on this subject in SUPPLEMENT, No. 160. 2. How can I make a good dry battery? A. For information on dry batteries see SCIENTIFIC AMERICAN, vol. 61, page 306. Dr. Gassner's dry battery.

(3293) E. E. T. asks: Can No. 27 double silk-covered copper wire be used instead of bare wire as given in directions about induction coil in chapter xx of "Experimental Science"? A. Silk-covered wire can be used, but it should be No. 36. 2. How is the current in above coil regulated, as it has no regulating tube? A. The secondary current is regulated by varying the primary current, either by plunging the elements of the battery more or less. This mode of regulation, however, is not very firm. In a spark coil firm regulation is seldom required.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

August 11, 1891.

AND EACH BEARING THAT DATE.

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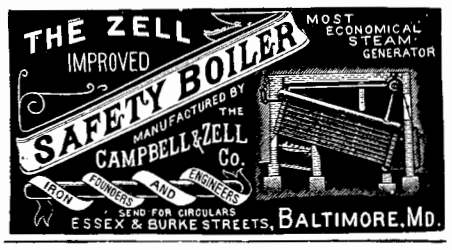

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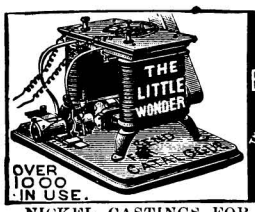

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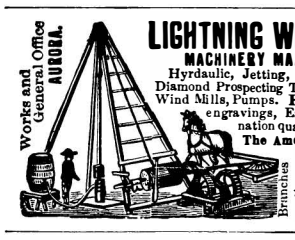

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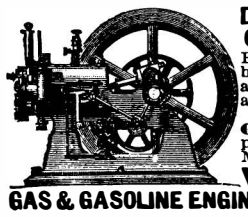

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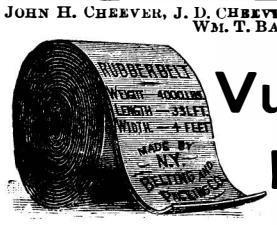

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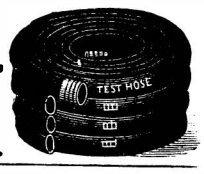

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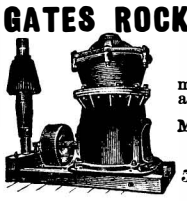

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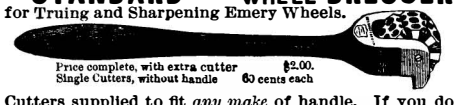

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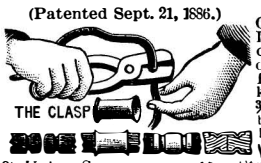

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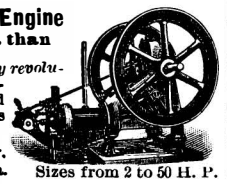

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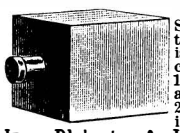

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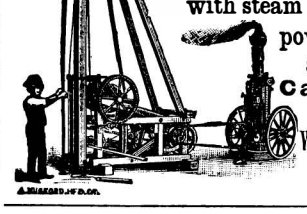

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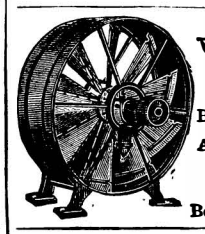

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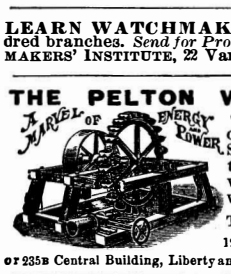

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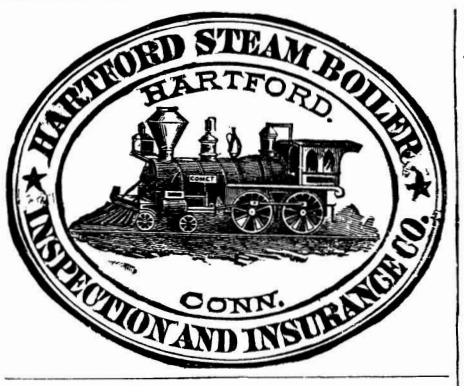

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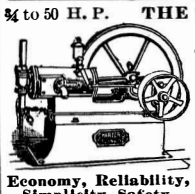

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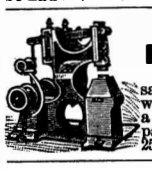

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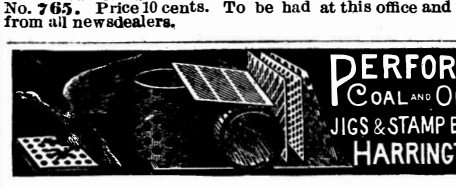
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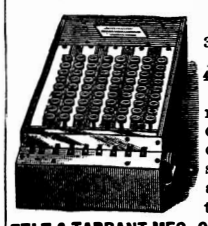

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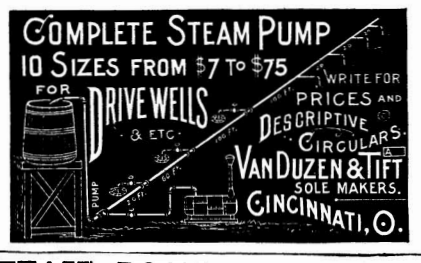
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